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VELOCITY MEASUREMENTS AT THREE FISH SCREENING FACILITIES IN THE YAKIMA RIVER BASIN, WASHINGTON ANNUAL REPORT SUMMER 1989

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VELOCITY MEASUREMENTS AT THREE FISH SCREENING FACILITIES

IN THE YAKIMA RIVER BASIN, WASHINGTON

ANNUAL REPORT

SUMMER 1989

by

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Prepared for

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Project Number 85-62

September 1990

PREFACE

The Bonneville Power Administration and the U.S. Bureau of Reclamation are funding the construction and evaluation of fish passage and protection facilities at irrigation and hydroelectric diversions in the Yakima River Basin, Washington State. This construction implements Sections 903(d) and 803(b) of the Northwest Power Planning Council's 1984 and 1987 Columbia River Basin Fish and Wildlife Program.(a) The program provides offsite enhancement to compensate for fish and wildlife losses caused by hydroelectric development throughout the Columbia River Basin, and addresses natural propagation of salmon to help mitigate the impact of irrigation in the Yakima River Basin.

The Wapato. Chandler, and Easton screens are three of the juvenile screening facilities. This report evaluates the flow characteristics of the screening facilities. Studies consisted of velocity measurements taken in front of the rotary drum screens and within the fish bypass systems during peak flows. Measurements of approach velocity and sweep velocity were emphasized in these studies: however, vertical velocity was also measured. Results indicate that velocity patterns within the screening facilities often differ from design specifications, but are generally conducive to effective fish bypass.

(a) NPPC (Northwest Power Planning Council). 1984. Columbia River Basin Fish and Wildlife Program. Northwest Power Planning Council, Portland, Oregon.

NPPC (Northwest Power Planning Council). 1987. Columbia River as in Fish and Wildlife Program. Northwest Power Planning Council, Portland, Oregon.

ACKNOWLEDGEMENTS

The involvement and cooperation of many people during these studies are greatly appreciated. Thomas J. Clune of the Bonneville Power Administration was the Project Manager. Robert Pearce of the National Marine Fisheries Service, NMFS. and Ken Bates of the Washington Department of Fisheries reviewed the plans for measuring velocities. Chuck Keller of the Bureau of Reclamation and his operations and maintenance staffs provided critical support and assistance during site preparation and data collection. Alvin L. Jensen ,NMFS. provided the instrumentation used in our studies. The manuscript was reviewed by Regina E. Lundgren and Wallace H. Walters.

ABSTRACT

The Pacific Northwest Laboratory (PNL)[a] measured the velocity conditions at three fish screening facilities in the Yakima River Basin: Wapato. Chandler, and Easton Screens. The measurement objectives were different at the three screens. At Wapato. approach and sweep velocities were measured to evaluate the effect of rearing pens in the screen forebay. A complete survey was preformed at the Chandler Screens. At Easton, velocity was measured behind the screens to provide information for the installation of porosity boards to balance flow through the screens.

Salmon-rearing pens used at the Wapato Canal had a minimal effect on the magnitude of approach and sweep velocities at the face of the drum screens, although the pens caused increased turbulence and variability in water velocities. The net pens did not appear to affect flows through the three fish bypasses.

Approach velocities at the Chandler Screens ranged from 0.1 fps at the upper end of the screening facility to >0.5 fps at the downstream end of the facility. Sweep velocity was generally <l.0 fps in the screen forebay, especially under the curvature of the drum screens. Low sweep velocities and elevated approach velocities under the curvature of the drum screens result in velocity conditions that do not meet the design criteria standards. Flow through each of the three fish bypasses was X2.0 fps. Sweep velocity in the separation chamber was <l.0 fps at 0.8 of the depth. Approach velocity at the face of traveling screens in the separation chamber was <0.5 fps. Water velocities in the fish return met design criteria.

Approach velocities at the Easton Screens varied from 0.1 fps to >0.6 fps from the upstream to the downstream end of the screening facility. Imbalanced flows throughout the screen array may be partially attributable to water flow around a bend in the canal upstream of the screen forebay that results in high sweeping velocity along the outer wall of the screen forebay.

(a) The Pacific Northwest Laboratory is operated by the Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC06-76RL0 1830.

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INTRODUCTION

The Pacific Northwest Electric Power Planning and Conservation Act (Public Law 96-501) was passed to enable preparation and implementation of a regional Conservation and Electric Power Plan. The Northwest Power Planning Council administers the plan, and is charged with developing a program to protect and enhance fish and wildlife populations and to mitigate adverse effects from development, operation, and management of hydroelectric facilities.

The Yakima River Basin was selected as one site for enhancement of salmon (Oncorhynchus spp.). Under the Plan, the Bonneville Power Administration (BPA) and the U.S. Bureau of Reclamation (BR) are funding the construction of fish passage and protection facilities at 20 existing irrigation and hydroelectric diversions in the Yakima River Basin (Figure 1).

The improvement of fish screening facilities in irrigation canals is a major component in the overall fisheries enhancement program. Hydrologists and biologists from various agencies, including the National Marine Fisheries Service (NMFS). the Washington Department of Fisheries, and the Yakima Indian Nation (YIN) provided input for the design of the new facilities. The angled rotary drum screen design was chosen as the best alternative for fish screening in irrigation canals.

Pacific Northwest Laboratory (PNL) conducted fisheries evaluations at six of the new fish screening facilities from 1985 through 1989 (Neitzel et al. 1985; 1987; 1988; 1990a; 1990b). The scope of the studies included the quantification of injury and mortality, predation, and passage effectiveness for emigrating salmonids: however, it did not include evaluating hydraulic characteristics within the screening facilities. The hydraulic conditions in front of the drum screens as well as within components of the fish guidance system (fish bypasses, separation chamber, and fish return slot) are critical in providing optimum conditions for safe fish bypass. The screens were designed to provide an approach velocity (perpendicular to the screens) of 0.5 feet per second (fps) or less to minimize impingement of fish and a sweep velocity (parallel to the screen face) of at least twice the magnitude of the approach velocity to guide fish into the bypass system (Easterbrooks 1984).

Inadequate sweep velocities, excessive approach velocities. or unequal discharges through the drum screens and fish bypass system have been observed at several of the screening facilities during our fisheries evaluations. These flow pattern anomalies can affect the overall efficiency of a facility. Velocity measurements were taken at six screen sites in 1988 (Abernethy et al. 1989) to monitor the actual velocity characteristics at selected facilities during normal operation, as defined by the operating criteria for each facility.

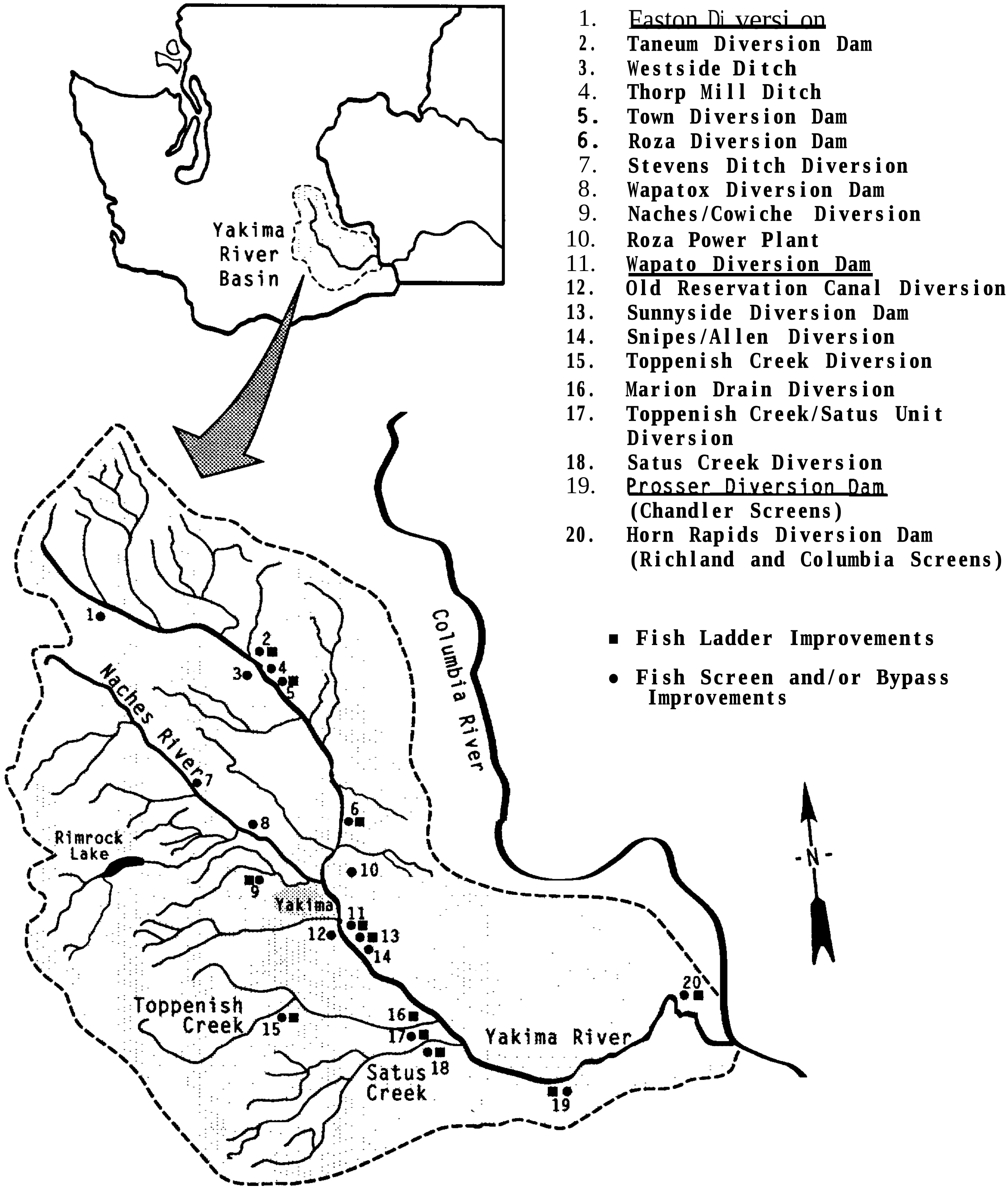


FIGURE I. Yakima River Basin Fish Screening Facilities and Other Fish Protection and Passage Facilities

This report describes additional velocity measurement studies conducted by PNL staff at the Wapato, Chandler, and Easton Screens in 1989. It describes the equipment and methods used to measure the hydraulic characteristics and the operating conditions at each facility during data collection, and summarizes the results and conclusions. The raw data are included in three appendixes (one for each site) to allow independent analysis of the data.

METHODS

Three monitoring protocols were used in our data collection based on the objectives of the measurements at each site. Measurements were taken at the Wapato Screens to evaluate the effect of the use of salmon-rearing pens in the canal forebay on flow parameters in front of the drum screens. Velocity readings for the X (approach velocity) and Y (sweep velocity) components were taken at 0.2 and 0.8 of the water depth in front of each drum screen and at the head of each fish bypass one day before and one hour after the net pens were removed from the Wapato Screens forebay. A complete survey, which included measurements at 0.05, 0.2, 0.5, 0.8, and 0.9 of the water depth in front of the drum screens and at 0.2 and 0.8 of the water depth in components of the fish bypass system was performed at the Wapato Screens in 1988 (Abernethy et al. 1989).

A complete survey was performed at the Chandler Screens. Velocity measurements were taken at 0.2 and 0.8 of the depth in front of each of the drum screens, in the fish bypasses, and in the separation chamber. Additional velocity measurements were taken at 0.05. 0.5, 0.8. and 0.9 of the depth in front of drum screens adjacent to each fish bypass (Figure 2). Velocity readings were taken to measure the X (approach velocity). Y (sweep velocity), and 2 (vertical velocity) components at all locations.

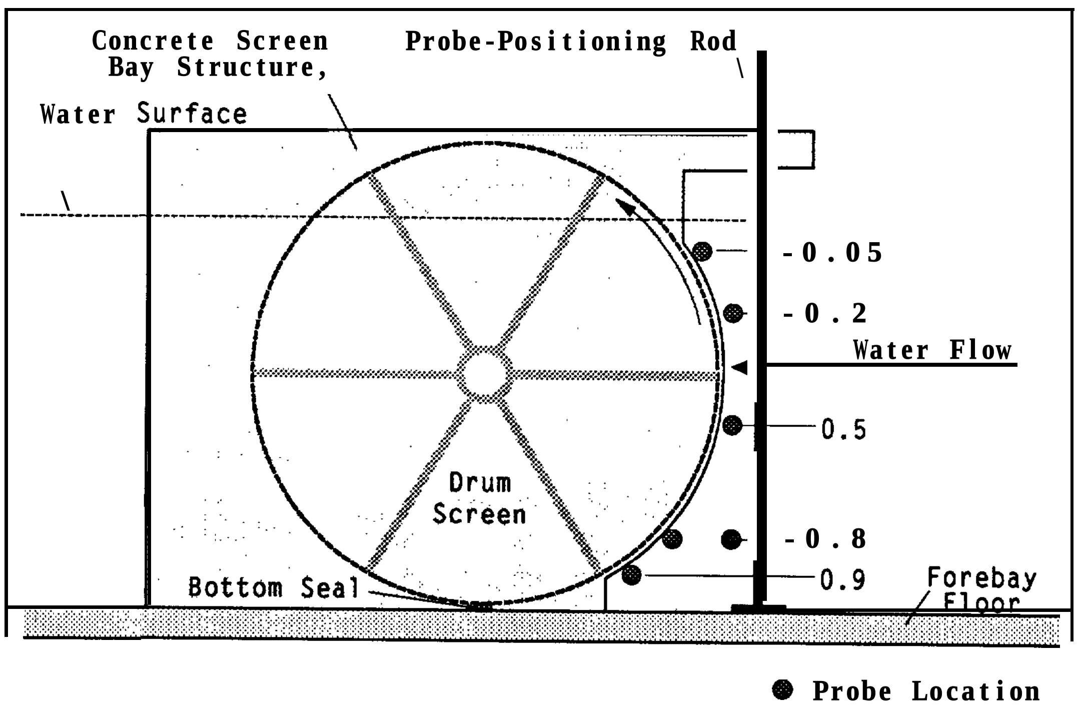


FIGURE. Measurement Depths and Probe Positioning Relative to the Front Face of Rotary Drum Screens in Complete Surveys

Velocity measurements were taken at 0.2 and 0.8 of the depth behind each of the drum screens at the Easton Screens to provide information for porosity board placement to balance flows through the screens. No flow measurements were taken in front of the drum screens or in the fish bypass system.

EQUIPMENT

Electromagnetic water current meters were used to monitor water velocities. Each meter used a bidirectional probe (Figure 3). Probes were mounted in pairs at the Chandler Screens so that one measured the X and Y and the other measured the Y and Z velocity components at a given depth. The vertical velocity (Z) component was not measured at the Wapato and Easton Screens: therefore, only one probe was necessary at each measurement location. A smaller electromagnetic water current meter, which measures flow in one direction only, was also used at the Easton Screens to compare the data obtained from different instruments. Outputs were read visually from panel gauges.

The meter probes were securely fastened to a horizontal arm that extended from a movable sleeve secured to a vertical pole. The length of the horizontal arm and the position of the sleeve on the vertical pole were adjustable. The probe support assembly was positioned at least 18 in. downstream or outside of the sensors so that the vertical pole and horizontal bracket arm would not disrupt velocity readings at the probes.

PROBE POSITIONING

The position of the probes was adjusted for each of the measurement locations within the facility. Measurements were taken in or near the drum screens, fish bypasses. separation chamber, vertical traveling screens, and the fish return.

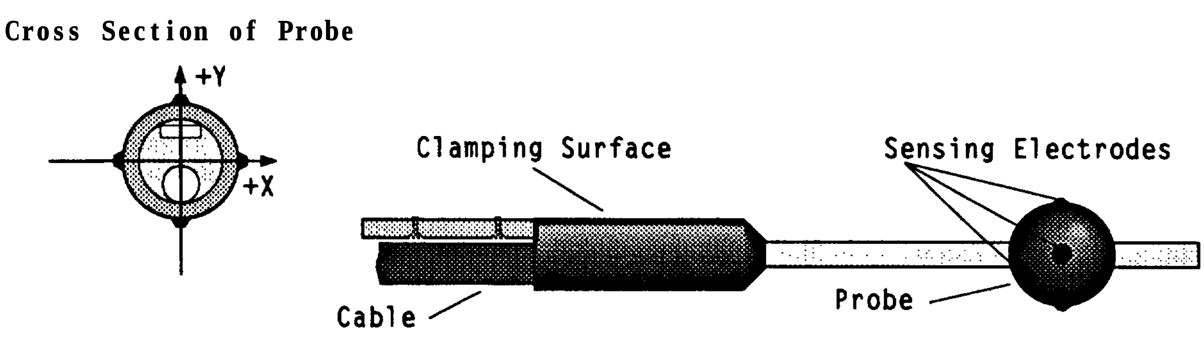


FIGURE. Bidirectional Electromagnetic Probes Used in Velocity Measurements

Measurements Near Drum Screens

For velocity measurements at the Wapato and Chandler screens, the vertical pole was positioned close to the perimeter in front of the screen; however. none of the components of the probe assembly were in contact with the screen face. The bottom of the pole rested on the forebay floor, and the top end of the pole was clamped to a fixed object, such as the gantry frame or a girder. Measurements at 0.2, 0.5, and 0.8 of the depth were taken by mounting the probes on a horizontal arm pointing upstream (Figure 4). and measurements near the screen face at 0.05, 0.8, and 0.9 of the depth were taken by mounting the probes on a horizontal arm pointed inward toward the face of the screen. The length of the horizontal arm required to position the probes close to the screen face was calculated based on screen diameter, water depth, and the position of the vertical pole relative to the perimeter of the screen. The set of probes was within 5 (±1) in. of the screen face for the near-screen measurements. The drum screens are constructed at an angle to the canal flow: therefore, all measurements were taken with the probe orientation parallel and perpendicular to the screen face, not to the canal flow. All velocity measurements were taken at the centerline of the screen.

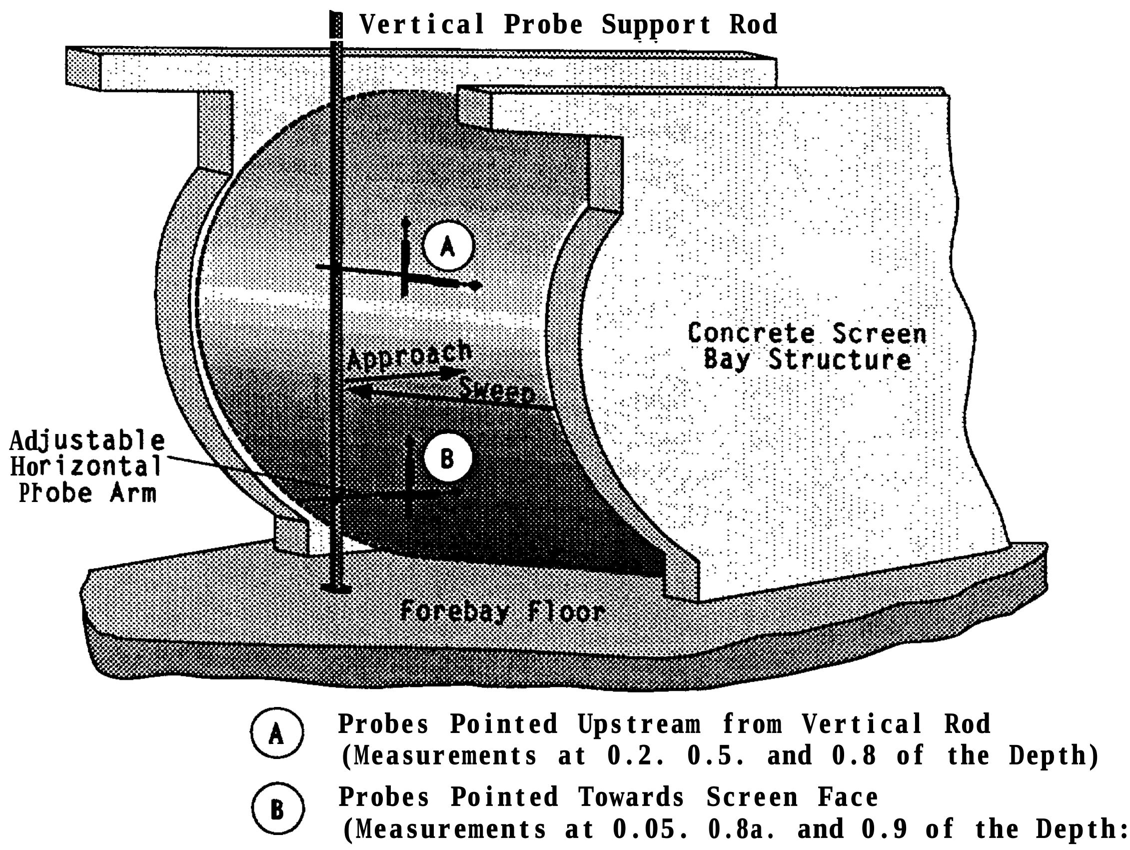


FIGURE 4. Relationship of Probe Support Assembly to Probes During Velocity Measurements

For velocity measurements at the Easton Screens, the vertical pole was positioned at the centerline of each drum screen about 15 in. from the screen surface on the back side of the screen. The horizontal arm supporting the probe for the bidirectional flow meter was oriented upstream so that the X and Y components could be measured. The probe for the unidirectional flow meter was pointed directly at the screen face, then slowly rotated to achieve the highest stable reading on the panel gauge.

Measurements in the Fish Bypasses

Measurements were taken at 0.2 and 0.8 of the depth at the centerline of the 24-in.-wide fish bypasses at the Wapato and Chandler Screens. All bypasses had submerged ramps to guide fish and water up from the bottom of the screen structure and over an adjustable weir at the back of the ramp. The probes were positioned about 18 in. upstream of the ramp. This positioning generally placed the probes within the concrete structure of the bypass.

Measurements in the Separation Chamber

Measurements were taken at 0.2 and 0.8 of the depth in transects across the width of the separation chamber at the Chandler screens. Transects were made upstream of the vertical traveling screens and at the centerline of each traveling screen. The traveling screens were constructed perpendicular to the separation chamber flow, with the outer wall (distal to the traveling screens) angling toward the screens. The probes were positioned pointing upstream parallel to the traveling screens. Turbulent areas where bypass flows mix at the head of the separation chamber were not evaluated.

Measurements Near Vertical Traveling Screens

Measurements were taken at 0.2 and 0.8 of the depth at the face of the traveling screens. The probes were positioned parallel to the screen face at the centerline and in the upper and lower quadrants at the Chandler Screens. The measurements along the screen face and the transects across the separation chamber merged to form a "T" pattern of velocity measurements.

Measurements in the Fish Return

Velocity measurements were taken at 0.2 and 0.8 of the depth in the fish return at the Chandler Screens near the upstream end of the fish return slot. The vertical pole was positioned upstream of the submerged approach ramp, but within the concrete structure of the fish return slot.

DATA COLLECTION AND ANALYSIS

Ten sets of velocity measurements were recorded in a 3- to 5-min interval. Each set of readings provided a "snapshot" of all velocity measurements. Beginning and ending times were recorded for each series of data. Unusual operating or canal flow conditions were recorded as "Notes" on the data sheets. Analyses and comparisons were performed using the means of the data.

DESCRIPTION OF CONDITIONS AT EACH SITE

Our data were collected during the peak of the irrigation season under the existing operating conditions at each site. The Chandler Canal was not at full capacity because of the frequent flow adjustments required to meet in-river flow obligations during periods of low river flow. Surface elevation and/or forebay depth were determined from staff gages at each site. Actual daily canal flows were provided by the Bureau of Reclamation. Unusual flow or operating conditions were recorded at each site.

WAPATO CANAL

The Wapato Screens (Figure 5) are located in the Wapato Canal on the right bank of the Yakima River at RM 106.7. The facility consists of 15 rotary drum screens (14 ft diameter, 24 ft long) and a fish bypass system that includes three fish bypasses (two intermediate and a terminal), a separation chamber with two bypass water recovery pumps located behind vertical traveling screens, and a fish return. The YIN uses the Wapato Screens forebay to house three pens for rearing fall chinook salmon (*O. tshawytscha*). The floating pens are attached to the outer wing wall opposite the screens near the second fish bypass (Figure 6).

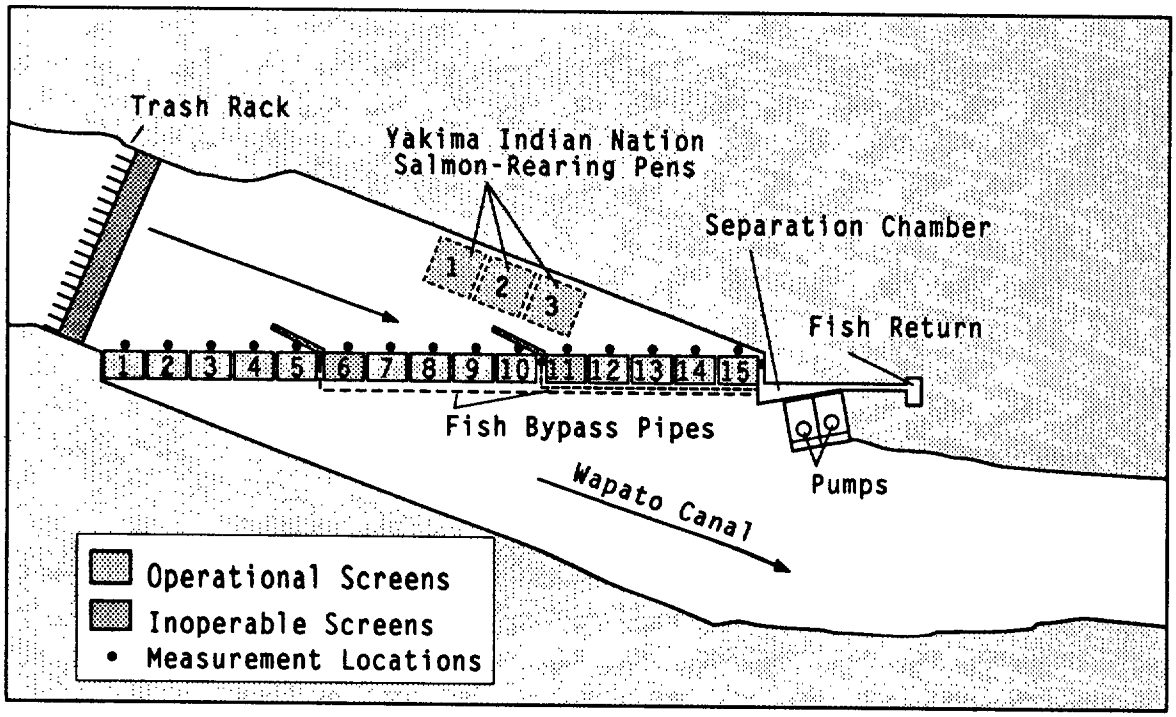


FIGURE. Locations of Facility Components and Rearing Pens at the Wapato Screens, Spring 1989

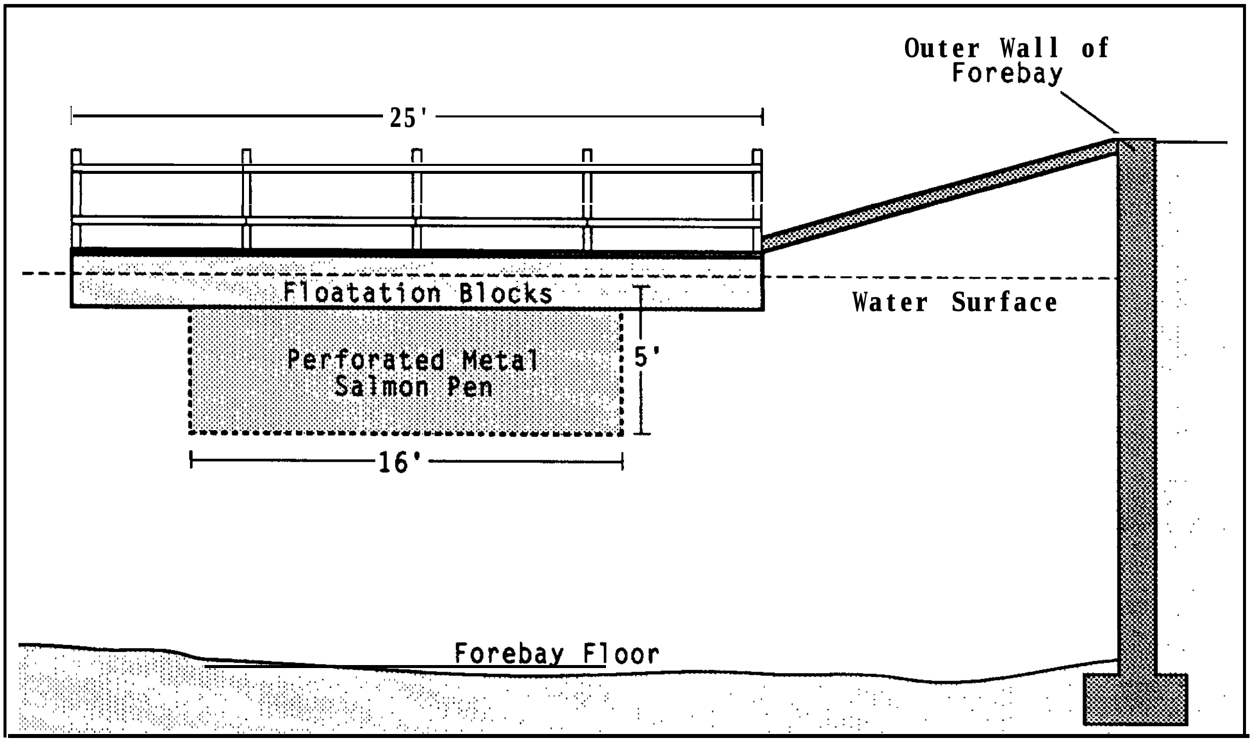


FIGURE. Pens Used by the Yakima Indian Nation to Rear Fall Chinook Salmon in the Wapato Screens Forebay

The forebay elevation is about 935 ft at the maximum canal flow of 1800 cubic feet per second (cfs). The first series of measurements was conducted at the Wapato Canal on June 1 and 2. 1989. Canal elevation was 934.9 ft, and the canal flow was 1830 cfs. Water depth in front of the screens was 140 in. Of the 168-in. drum screen diameter, 132 in. (79%) were submerged. We used the submerged screen depth as the basis for calculating probe positioning.

All operating conditions were normal (Appendix A) with the following exceptions:

- The vertical traveling screens in the separation chamber were not in service.
- Rotary drum screens 6 and 11 were not operational.
- Three YIN salmon-rearing pens were in use in the screen forebay.

The second series of velocity measurements was completed on June 5 and 6. 1989, after the YIN salmon pens were removed from the canal forebay. The surface elevation in the canal was 934.85 ft, and the canal flow was 1850 cfs. All other operating conditions were the same as during the first series of measurements except that the three salmon net pens had been removed.

CHANDLER CANAL

The Chandler Screens (Figure 7) are located in the Chandler Canal on the right bank of the Yakima River. The head gates of the Chandler Canal withdraw water from the Yakima River at the Prosser Diversion Dam at RM 47.0 near Prosser. Washington. The facility consists of 24 rotary drum screens (13.5 ft diameter, 12 ft long) and a fish bypass system that includes three fish bypasses (two intermediate and a terminal), a separation chamber with four bypass water recovery pumps located behind vertical traveling screens, and a fish return. The forebay elevation is about 631 ft at the maximum canal flow of 1400 cfs.

A complete survey was conducted at the Chandler Screens on July 26 to 28, 1989. Canal elevation was 630.1 ft. and the canal flow was 1050 to 1100 cfs. Water depth in front of the screens was 112 in. Of the 162-in. drum screen diameter, 108 in. (67%) were submerged. We used the submerged screen depth as the basis for calculating probe positioning.

All operating conditions were normal Appendix A) with the following exceptions:

- Screen 23 was inoperable and stoplogged shut.
- Only two of the four bypass water return pumps were operating.

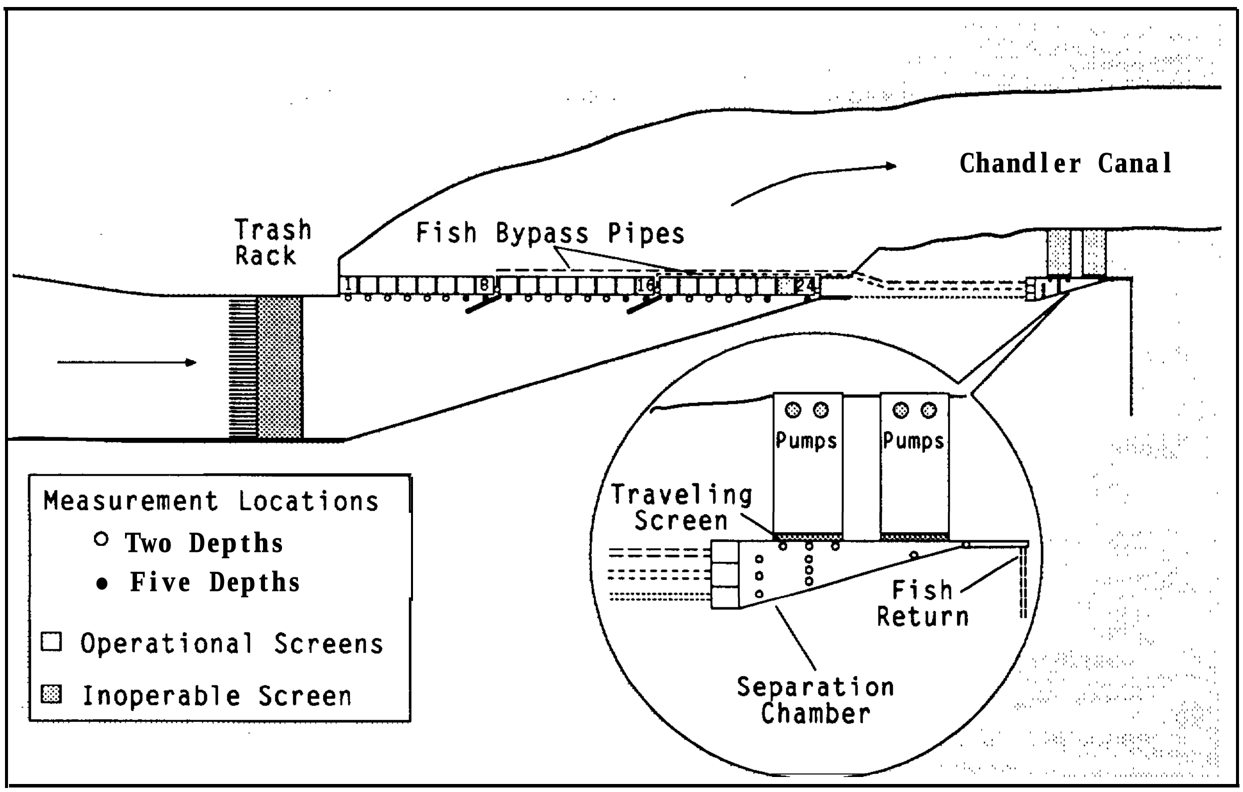


FIGURE. Locations of Facility Components at the Chandler Screens, Spring 1989

EASTON CANAL

The Easton Screens (Figure 8) are located in the Kittitas Main Canal on the right bank of the Yakima River at RM 202.5 near Easton, Washington. The facility consists of 18 rotary drum screens (15 ft diameter, 12 ft long) and a fish bypass system that includes two fish bypasses (intermediate and terminal), each with a flow of 20 cfs, and a fish return. The maximum canal flow is about 1200 cfs. Flow measurements were taken at the Easton Screens on June 14 and 15. 1989 with a canal flow of 1130 cfs. Water depth behind the screens was 139 in. All operating conditions were normal (Appendix A).

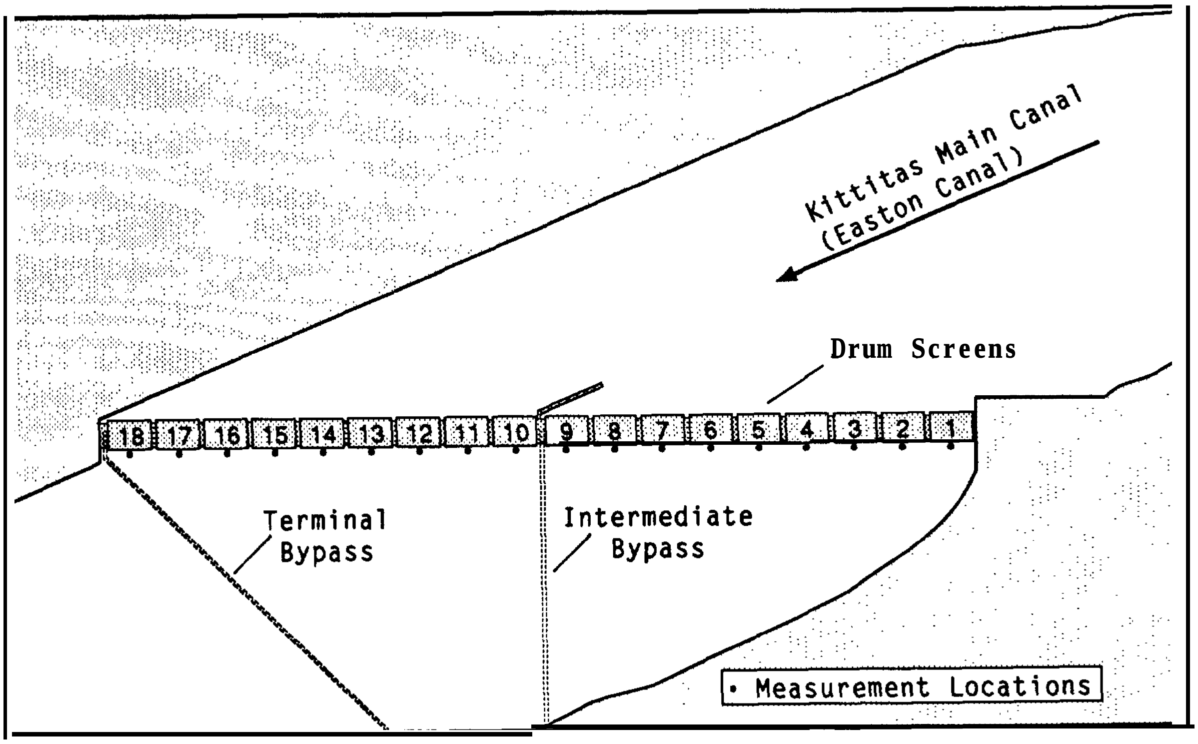


FIGURE. Probe Locations for Flow Velocity Measurements at the Easton Screens, Spring 1989

RESULTS

The objective of our velocity measurements differed at each of the three sites. Velocity measurements performed at the Wapato Screens evaluated flow conditions near the drum screens relative to the use of salmon-rearing pens in the screen forebay. A complete survey was performed at the Chandler Screens. Velocity measurements performed at the Easton Screens evaluated flow balance through the array of screens.

WAPATO SCREENS

Velocity measurements taken before and after the removal of three salmon-rearing pens from the Wapato Screens forebay indicated that although the pens had only a minimal effect on actual approach and sweep velocities at the face of the drum screens, the pens contributed to increased turbulence and instability of the water flow. Swirls and turbulence at the face of drum screens could result in intermittent increases in approach velocities. The net pens did not appear to affect flows through the three fish bypasses.

The magnitude of the approach velocity was not affected at 0.2 of the depth (Figure 9). 0.8 of the depth (Figure 10). or under the curvature of the screens at 0.8 of the depth (Figure 11). Variability of the approach velocity was greater at the two 0.8 readings when the pens were in use.

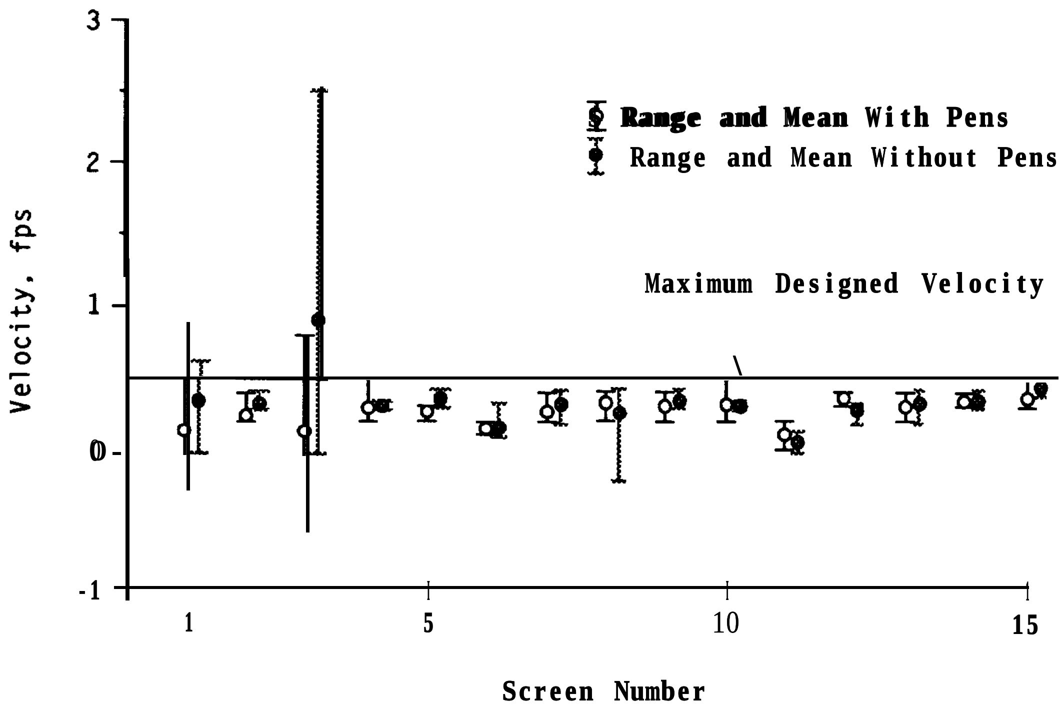


FIGURE 9. Approach Velocity at 0.2 of the Depth in Front of Drum Screens at the Wapato Canal, Spring 1989

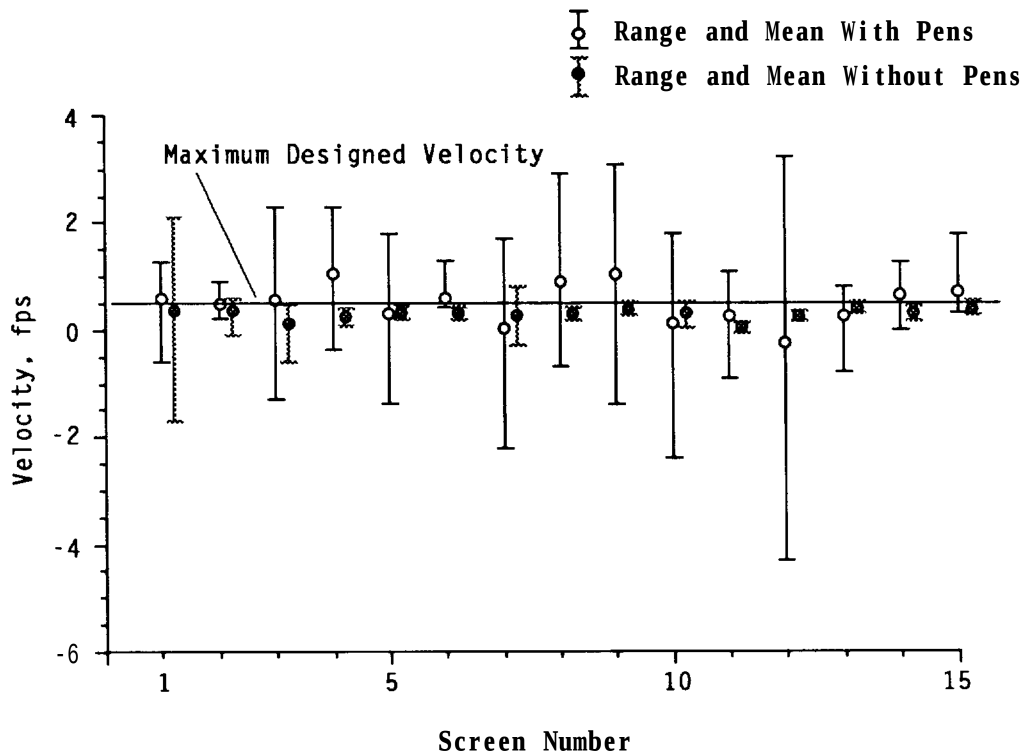


FIGURE 10. **Approach Velocity at 0.8 of the Depth in Front of Drum Screens at the Wapato Canal, Spring 1989**

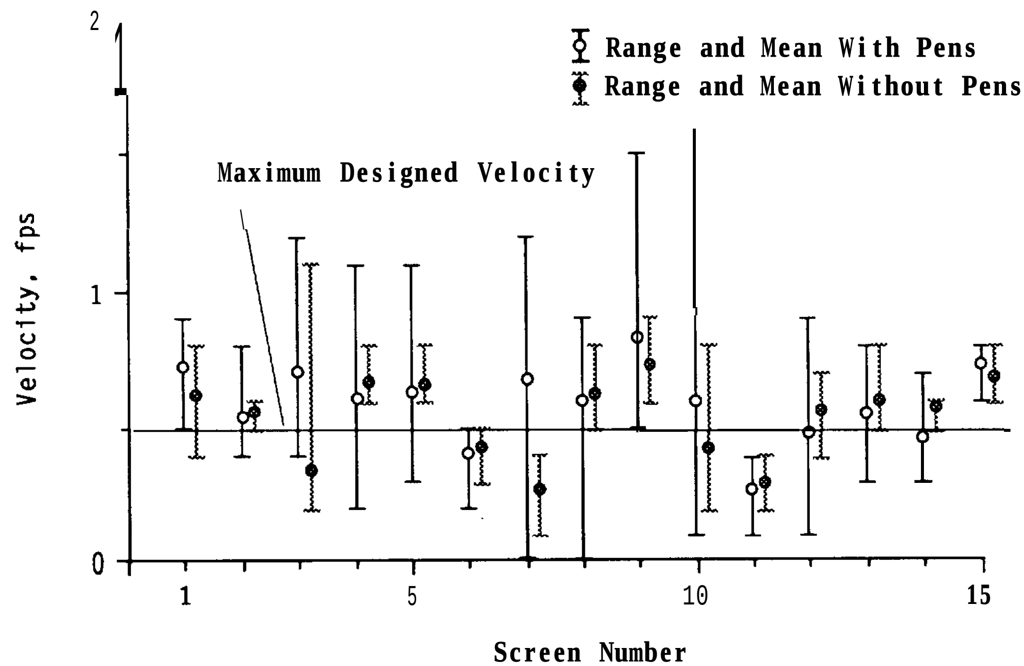


FIGURE 11. **Approach Velocity at 0.8 of the Depth Under the Curvature of Drum Screens at the Wapato Canal, Spring 1989**

Sweep velocity increased at 0.2 of the depth (Figure 12) and decreased at 0.8 of the depth (Figure 13) when the net pens were removed. Sweep velocity under the curvature of the drum screen at 0.8 of the depth was only slightly affected (Figure 14). Variation of the sweep velocity measurements was greater at all three of the measurement locations when the pens were in use.

Flow was balanced through the three fish bypasses both with and without the pens in the forebay. Velocity in each of the bypasses increased at 0.2 of the depth and decreased at 0.8 of the depth when the pens were removed (Table 1).

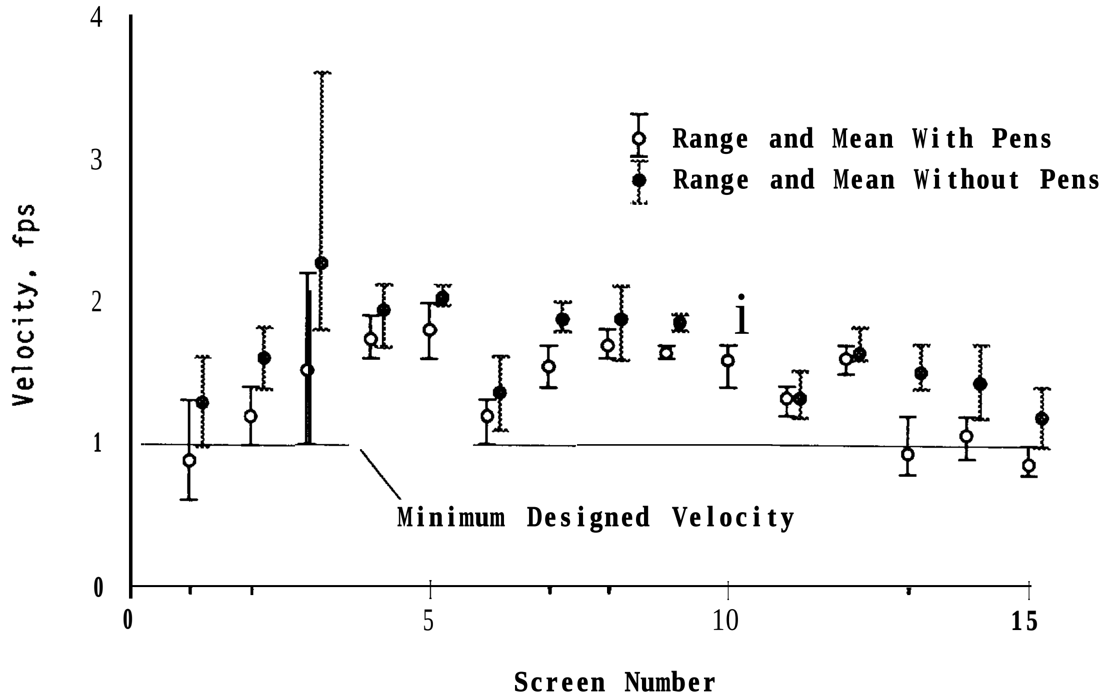


FIGURE 12. Sweep Velocity at 0.2 of the Depth in Front of Drum Screens at the Wapato Canal, Spring 1989

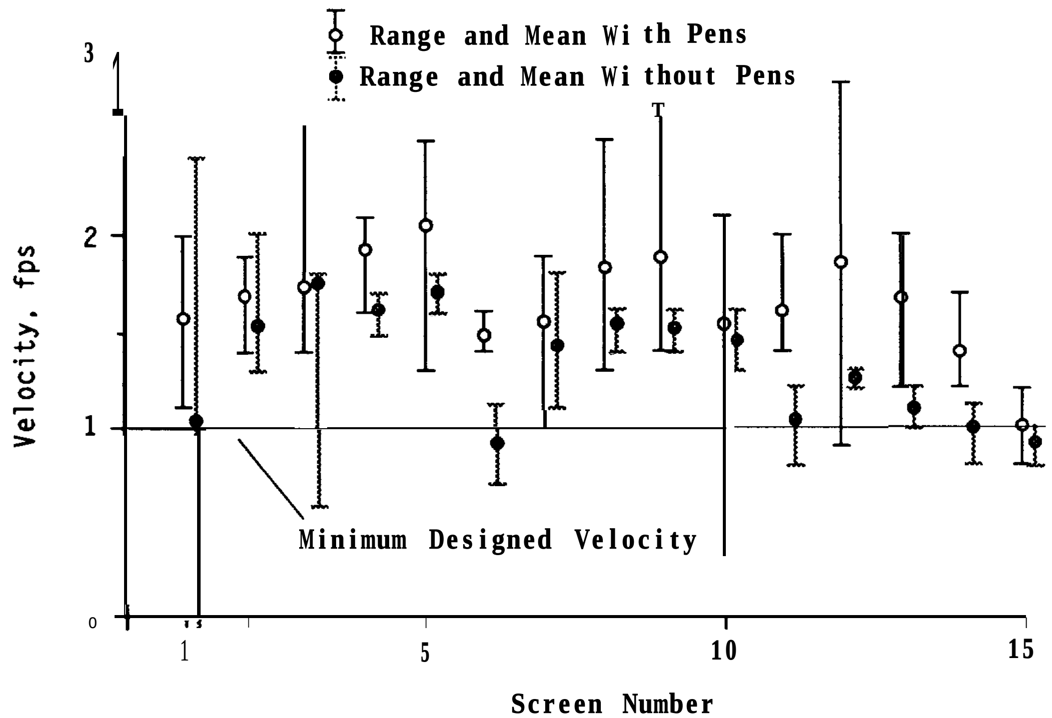


FIGURE 13. Sweep Velocity at 0.8 of the Depth in Front of Drum Screens at the Wapato Canal, Spring 1989

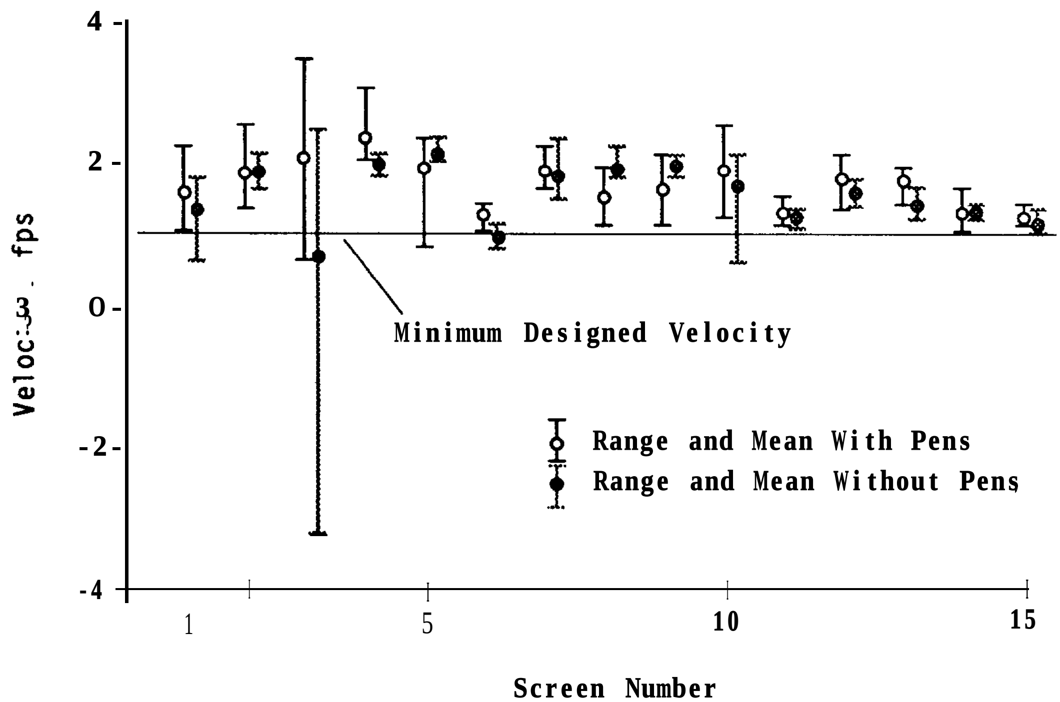


FIGURE 14. Sweep Velocity at 0.8 of the Depth Under the Curvature of Drum Screens at the Wapato Canal, Spring 1989

TABLE 1. Approach Velocities (fps) at the Head of Fish Bypasses at the Wapato Canal, Spring 1989

Bypass #	0.3 Depth With Pens	0.3 Depth Without Pens	0.8 Depth With Pens	0.8 Depth Without Pens
1	1.57	1.76	1.56	1.28
2	1.79	1.97	1.57	1.25
3	1.68	1.79	1.44	1.21

CHANDLER SCREENS

Velocity measurements varied throughout the facility. The variability resulted in measurements being different from the design criteria.

Approach velocity exceeded 0.5 fps by more than 10% at 12 of the 76 measurement locations (Table 2). Most of the high approach velocities occurred under the curvature of the drum screens at 0.8 and 0.9 of the depth. Approach velocity was low in front of screens at the upstream end of the facility but nearly equal to the 0.5-fps standard in front of screens at the downstream end of the facility. Wing walls had little affect on approach velocity.

Sweep velocity resulting in less than a 2:l sweep-to-approach ratio occurred at 13 (17%) of the 76 measurement locations, and was <l.0 fps at 40 (53%) locations. Low sweep velocity was most evident at 0.9 of the depth. Sweep velocities under the curvature of the drum screens at 0.8 of the depth were comparable to sweep velocities measured in front of the drum screens; however, the high approach velocities under the curvature of the drum screen resulted in a poor sweep-to-approach ratio. Sweep velocity was low in the upstream third of the facility, highest in the middle third of the facility, and slightly reduced in the downstream third of the facility.

Vertical velocity was generally low throughout the facility. Disruptions in flow associated with vertical movement of water, such as upwelling and swirling, were not evident during our sampling.

Flow through the terminal fish bypass (bypass 3) was lower than through the two intermediate bypasses, based on sweep velocity measurements taken in the entrance of the three fish bypasses (Table 3). Additionally, overall fish bypass flow was less than is specified in the operating criteria. Only two of the four pumps in the separation chamber were operating during our measurement series.

TABLE Summary of Approach (X), Sweep (Y), and Vertical (Z) Velocity Measurements (fps) in Front of the Drum Screens at the Chandler Canal. Summer 1989

	0.2			0.8			0.05			0.5			0.8(a)			0.9(a)		
Screen	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
1	0.10	0.48	-0.06	0.20	0.33	-0.02												
2	0.10	0.60	-0.09	0.10	0.55	-0.03												
3	0.11	0.71	-0.13	0.13	0.62	-0.04												
4	0.18	0.86	-0.07	0.19	0.72	-0.01												
5	0.20	0.87	-0.12	0.20	0.75	-0.03												
6	0.20	0.90	-0.11	0.21	0.78	-0.05												
7	0.29	0.97	-0.09	0.27	0.73	-0.01	0.24	0.92	-0.09	0.27	0.88	-0.08	0.70	1.82	-0.12	0.35	0.58	0.13
8	0.30	0.92	-0.12	0.28	0.68	-0.02	0.29	0.94	-0.17	0.28	0.79	-0.07	0.76	1.79	0.29	0.38	0.43	0.10
9	0.35	1.10	-0.11	0.39	0.77	0.05	0.30	1.14	-0.09	0.37	1.02	-0.14	0.79	1.69	-0.38	(b)	(b)	(b)
10	0.30	1.17	-0.13	0.34	1.16	-0.10												
11	0.30	1.23	-0.13	0.30	1.10	-0.06												
12	0.30	1.27	-0.10	0.30	1.07	-0.04												
13	0.30	1.04	-0.12	0.30	1.07	-0.04												
14	0.30	1.24	-0.10	0.30	1.00	-0.01												
15	0.40	1.02	-0.06	0.32	0.98	0.02	0.31	1.27	-0.08	0.36	1.12	-0.04	0.48	1.08	0.09	0.50	0.77	0.10
16	0.40	1.18	-0.03	0.32	0.91	0.33	0.40	1.14	-0.06	0.39	1.06	0.04	0.58	1.19	0.13	(b)	(b)	(b)
17	0.50	1.27	-0.12	0.74	0.86	-0.06	0.50	1.26	-0.10	0.59	0.88	-0.17	0.83	0.92	-0.15	0.83	0.63	0.01
18	0.39	1.18	-0.13	0.49	0.98	-0.05												
19	0.41	1.17	-0.12	0.48	1.02	-0.08												
20	0.40	0.99	-0.12	0.48	0.94	-0.07												
21	0.40	1.25	-0.12	0.52	0.80	-0.06												
22	0.50	1.05	-0.11	0.54	0.65	-0.01	0.40	1.15	-0.10	0.48	0.90	-0.06	0.67	0.97	-0.07	0.74	0.58	0.08
23	Not in operation																	
24	0.49	0.98	-0.10	0.50	0.94	-0.02	0.50	1.21	-0.10	0.51	1.03	-0.05	0.70	1.16	-0.01	0.69	1.01	0.10

(a) Measurement made under curvature of the screens: all others made in front of screens.
(b) Obstruction under the screens: no data.

TABLE 3. **Summary of Approach (X), Sweep (Y), and Vertical (Z) Velocity Measurements (fps) at the Entrance to the Fish Bypasses at the Chandler Canal, Summer 1989**

Bypass	0.7 Depth X	0.7 Depth Y	0.7 Depth Z	0.8 Depth X	0.8 Depth Y	0.8 Depth Z
1	-0.06	1.98	0.11	0.24	1.18	0.21
2	-0.11	1.73	0.19	-0.23	1.49	0.31
3	0.06	1.38	0.24	-0.54	1.26	0.47

Sweep velocity in the upstream end of the separation chamber is surface-oriented (Figure 15, Table 4). Sweep velocity at 0.8 of the depth increases from zero at the upstream end of the separation chamber to about 60% of the sweep velocity at 0.2 of the depth near the entrance to the fish return slot. Based on the cross-sectional area in the fish return, the fish return flow was about 25 cfs, with slightly more water entering the fish return from the surface.

Approach velocity was less than 0.5 fps at the face of the first traveling screen (Table 5. Figure 16). The lack of sweep velocity at 0.8 of the depth observed in velocity measurements in the upstream end of the separation chamber persisted in front of the first traveling screen. Because of limited accessibility, no measurements were taken in front of the second traveling screen.

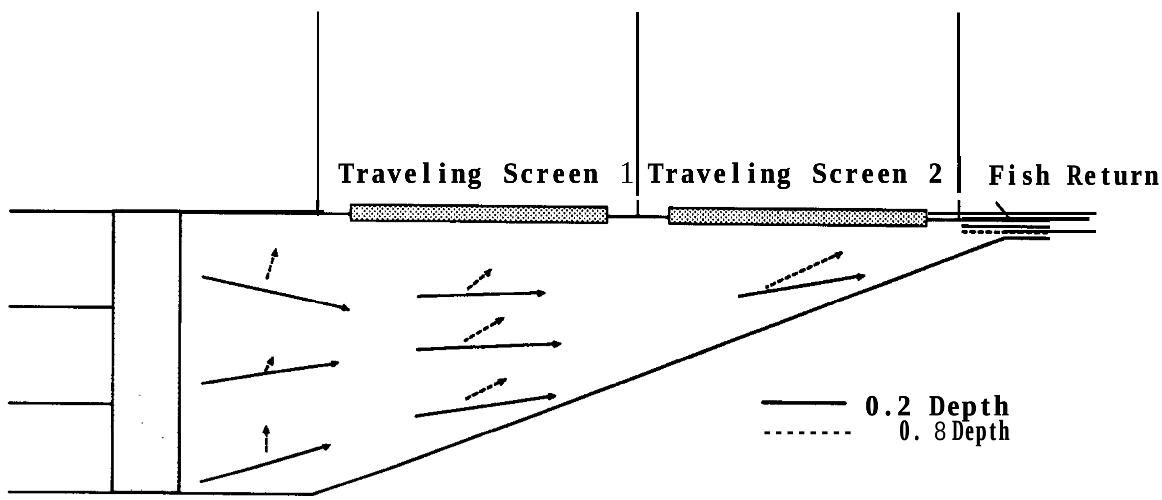


FIGURE 15. **Flow Patterns (Plane View) in the Chandler Screens Separation Chamber as Described by Velocity Data and Visual Observations of the Water Surface**

TABLE Summary of Approach (X), Sweep (Y), and Vertical (Z) Velocity Measurements (fps) in the Separation Chamber and Fish Return at the Chandler Canal, Summer 1989

Transect[a]	Position(b)	0.2 Depth X	0.2 Depth Y	0.2 Depth Z	0.8 Depth X	0.8 Depth Y	0.8 Depth Z
Upper	Outer	0.52	1.67	-0.39	0.28	0.0	-0.01
	Center	0.19	1.76	-0.20	0.18	0.01	-0.20
	Inner	-0.41	1.90	-0.36	0.40	0.01	-0.18
Screen 1	Outer	0.20	1.84	-0.31	0.27	0.53	-0.25
	Center	0.09	1.87	-0.27	0.30	0.49	-0.08
	Inner	0.07	1.66	-0.20	0.37	0.32	-0.06
Screen 2	Center	0.29	1.64	-0.21	0.46	0.99	-0.18
Fish Return[c]		0.01	1.75	-0.04	0.02	1.33	0.04

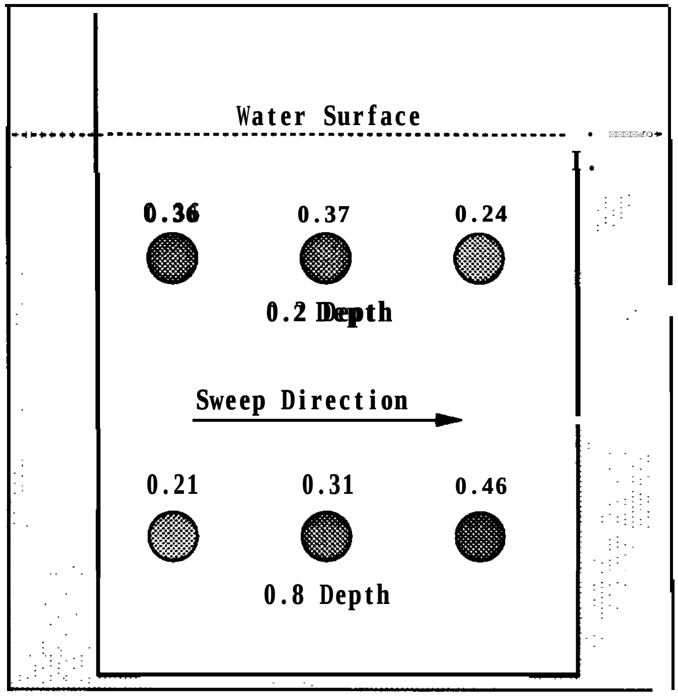
a Upper transect is across the separation chamber upstream of the first traveling screen: Screen 1 and Screen 2 transects are adjacent to the centerline of each screen.

b Outer position is 1 ft from the outer wall: center position is midway between the outer wall and the catwalk in front of the traveling screens; inner position is adjacent to the catwalk, about 5 ft from the face of the traveling screens.

c Measurements were taken at the centerline of the fish return slot near the entrance.

TABLE 5. Summary of Approach (x). Sweep (Y). and Vertical (Z) Velocity Measurements (fps) at the Face of the First Traveling Screen at the Chandler Canal, Summer 1989

Position	0.2 Deoth X	0.2 Deoth Y	0.2 Deoth Z	0.8 Depth X	0.8 Depth Y	0.8 Depth Z
Upper	0.36	1.09	0.27	0.21	-0.05	0.29
Center	0.37	0.88	0.05	0.33	-0.17	0.43
Lower	0.24	0.86	0.06	0.46	-0.13	0.19



FIGURF 16. Approach (Impingement) Velocity at the Face (Side View) of the First Traveling Screen in the Chandler Screens Separation Chamber

EASTON SCREENS

The low flow through drum screens at the upstream end of the Easton Screens indicates that porosity boards are needed to balance flows. Flow through the screens may be partially attributable to water flow around a bend in the canal upstream of the screens forebay that results in high sweeping velocity along the outer wall of the screens forebay.

Velocity measurements taken on June 14 with a unidirectional water current meter and on June 15 with a two bidirectional (Figure 17) water current meters produced similar results. Overall, velocities measured with the unidirectional meter were slightly higher than the velocities measured with the bidirectional instruments: however, the difference may be a result of the maximum stable reading observed with the unidirectional meter, which was recorded for the data set, while ten velocity readings with the bidirectional meters were averaged to produce the data set.

Velocity through the drum screens was lowest through the screens at the upstream end of the facility and steadily increased throughout the length of the facility. The highest velocities were observed at the last three screens (Screens 16 through 18). Velocity across the screen face has little meaning because the velocity measurements were made in the screen bays behind the drum screens.

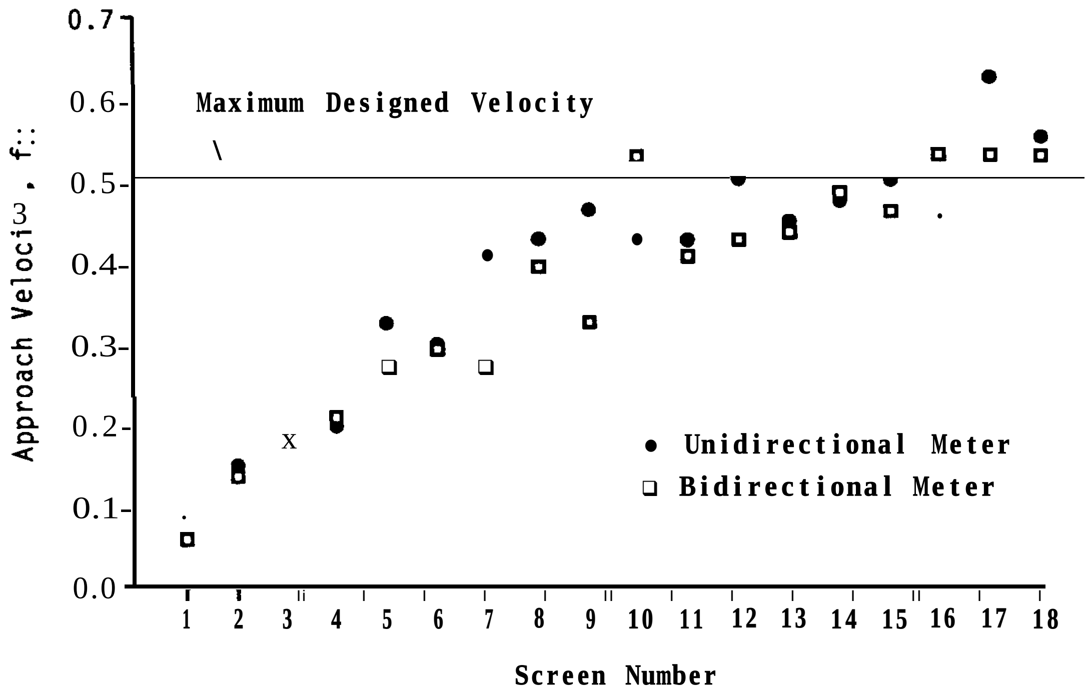


FIGURE 17. Velocity Measurements to Evaluate Flow Balance Through the Drum Screens at the Easton Canal, Summer 1989

DISCUSSION

The measurement objectives were different at each screen facility. At Wapato, approach and sweep velocity measurements were taken to evaluate the effect of rearing pens in the screen forebay. At Chandler, approach, sweep, and vertical velocity measurements were taken in front of the rotary drum screens. Velocities were also measured at the entrance of fish bypasses, in front of traveling screens in the separation chambers, and in the entrance to the fish return. At Easton. velocity was measured behind the screen to provide information for designing porosity boards to balance flow through the screens.

EFFECT OF SALMON-REARING PENS ON VELOCITY MEASUREMENTS AT THE WAPATO SCREENS

Velocity measurements taken at the Wapato Screens before and after the removal of the YIN salmon-rearing pens show that the pens can affect both the magnitude and stability of water velocity in front of the drum screens. Approach and sweep velocities were erratic in front of the drum screens when the pens were in the forebay and stable after the pens were removed. The magnitude of approach velocity at the screen face was not affected; however, the sweep velocity was less at 0.2 of the depth and greater at 0.8 of the depth when the pens were in place.

The unstable velocity readings we observed are believed to be the result of swirling water moving along the face of the drum screens, based on visual observations made during data collection. Swirling water could result in intermittent high impingement velocities for small fish as the swirl moves along the face of the screens: however, no fish impingement was observed on drum screens adjacent to the rearing pens in screen integrity tests conducted in 1988 ((Neitzel et al. 1990b).

Velocity measurements taken at the Wapato Canal with the rearing pens in the screen forebay did not compare well with data collected in 1988 (Abernethy et al. 1989) under similar canal flow and operating conditions. Factors that might have caused differences in the two data sets are

- differences in sedimentation in the screen forebay
- the location and number of inoperable screens when the measurements were made
- the degree of algal fouling on the screen panels in the rearing pens
- day-to-day variation of hydraulic conditions within the canal.

The greatest discrepancies in velocities between the two data sets occurred in measurement locations that were adjacent to inoperable screens or wing walls.

VEIOCITY CHARACTFRISTICS AT THF CHABDIFR SCREFJJ

Water flow in the Chandler Screens forebay was very uniform, based on visual observation. Few current lines or swirls were visible. However, it appeared that the canal forebay is too wide to maintain an adequate sweeping velocity in front of the screens. Additionally, our velocity measurements indicated that porosity boards will probably be required to achieve more flow through the drum screens at the upstream end of the facility.

Low flows through drum screens at the upstream end appear to be a common problem at screening facilities with the drum screens installed at an angle to canal flow. Modification in hydraulics resulting from installation of porosity boards may be partially responsible for increased turbulence in the screen forebay.

Based on velocity measurements at the entrance of each of the three fish bypasses and in the separation chamber. fish return flow did not meet design criteria specifications. Although approach velocities did not exceed 0.5 fps during our data collection, only one of the two pumps behind each screen was operating. During four-pump operation of the separation chamber, impingement velocities could increase substantially at the face of the traveling screens.

FLOW BALANCE AT THE EASTON SCREENS

The low flow through drum screens at the upstream end of the Easton Screens indicates that porosity boards are needed to balance flows. Poor flow through the screens may be partially attributable to water flow around a bend in the canal upstream of the screen forebay that results in high sweeping velocity along the outer wall of the forebay. Porosity boards were installed following our measurement series, and flow balance through the screens was improved (Hosey & Associates 1989).

SUMMARY

Velocity measurements were conducted at three fish screening facilities in the Yakima River Basin: the Wapato, Chandler, and Easton Screens. Our objective at the Wapato Screens was to determine if the salmon-rearing pens in the forebay adversely affected flow parameters in front of the drum screens. At the Chandler Screens, our objective was to determine if velocity parameters in front of the rotary drum screens and within components of the fish bypass system were consistent with design specifications necessary to provide effective fish bypass. The objective of flow measurements at the Easton Screens was to determine where porosity boards were needed to equalize water flow through the drum screens.

WAPATO SCREENS

Velocity measurements taken before and after the removal of three salmon-rearing pens from the screen forebay indicated that although the pens had only a minimal effect on actual approach and sweep velocities at the face of the drum screens, the pens contributed to increased turbulence and instability of the water flow. Swirls and turbulence at the face of drum screens could result in intermittent increases in approach velocities. The net pens did not appear to affect flows through the three fish bypasses.

CHANDLER SCREENS

Approach velocity was low in front of the drum screens at the upstream end of the facility but steadily increased in front of drum screens at the downstream end of the facility. Porosity boards are needed to balance flow through the array of screens.

Sweep velocity was generally low in the Chandler Screens forebay, especially under the curvature of the drum screens. Low sweep velocities and elevated approach velocities under the curvature of the drum screens result in velocity conditions that do not meet the design criteria standards.

Flow through each of the three fish bypasses were less than specified in the operating criteria. Sweep velocity in the separation chamber was generally low. Approach velocity at the face of traveling screens in the separation chamber were within design criteria guidelines; however, only two of the four bypass pumps were operating when the measurements were taken. Flow out the fish return pipe appeared to be adequate.

EASTON SCREENS

The low flow through drum screens at the upstream end of the Easton Screens indicates that porosity boards are needed to balance flows. Poor flow through the screens may be partially attributable to water flow around a bend in the canal upstream of the screen forebay that results in high sweeping velocity along the outer wall of the forebay. Porosity boards were installed following our measurement series, and flow balance through the screens was improved (Hosey b Associates 1989).

REFERENCES

Abernethy, C. S., D. A. Neitzel, and E. W. Lusty. 1989. Velocity Measurements at Six Fish Screening Facilities in the Yakima River Basin, Washington, Summer 1989. Prepared by the Pacific Northwest Laboratory, Richland, Washington, for the Division of Fish and Wildlife, Bonneville Power Administration, Portland, Oregon.

Easterbrooks, J. A. 1984. Juvenile Fish Screen Design Criteria: A Review of the Objectives and Scientific Data Base. State of Washington Department of Fisheries, Habitat Management Division, Yakima, Washington.

Hosey & Associates. 1990. Easton Facility Evaluation. Evaluation of Effectiveness of Fish Protection Facilities. Prepared by Hosey & Associates Engineering Company and Fish Management Consultants, Bellevue, Washington, for the U.S. Bureau of Reclamation, Yakima, Washington.

Neitzel, D. A., C. S. Abernethy. E. W. Lusty, and L. A. Prohammer. 1985. A Fisheries Evaluation of the Sunnyside Canal Fish Screening ··les. Spring 1985. Prepared by the Pacific Northwest Laboratory, Richland. Washington, for the Division of Fish and Wildlife, Bonneville Power Administration, Portland, Oregon.

Neitzel. D. A., C. S. Abernethy, and E. W. Lusty. 1987. A Fisheries Evaluation of the Richland and Toppenish/Satus Canal Fish Screening Facilities. Spring 1986. Prepared by the Pacific Northwest Laboratory, Richland. Washington, for the Division of Fish and Wildlife, Bonneville Power Administration, Portland, Oregon.

Neitzel. D. A., C. S. Abernethy, E. W. Lusty, and S. J. Wampler. 1988. A Fisheries Evaluation of the Richland and Wapato Canal Fish Screening ilities. Spring 1987. Prepared by the Pacific Northwest Laboratory, Richland. Washington, for the Division of Fish and Wildlife, Bonneville Power Administration, Portland, Oregon.

Neitzel, D. A., C. S. Abernethy. and E. W. Lusty. 1990a. A Fisheries Evaluation of the Toppenish Creek. Wapato, and Sunnyside Fish Screening ··ies Spring 1988. Prepared by the Pacific Northwest Laboratory, Richland, Washington for the Division of Fish and Wildlife, Bonneville Power Administration, Portland, Oregon.

Neitzel, D. A., C. S. Abernethy, and E. W. Lusty. 1990b, in press. A Fisheries Evaluation of the Westside Ditch and Wapato Canal Fish Screening Facilities Spring 1990. Prepared by the Pacific Northwest Laboratory, Richland. Washington, for the Division of Fish and Wildlife, Bonneville Power Administration, Portland, Oregon.

APPENDIX 4

OPERATING CRITERIA FOR THE WAPATO, CHANDLER, AND EASTON FISH SCREENING FACILITIES

APPENDIX A

OPERATING CRITERIA FOR THE WAPATO. CHANDLER. AND EASTON FISH SCREENING FACILITIES

This appendix contains the operating criteria for the three fish screening facilities included in this report. The criteria were developed by hydrologists from the National Marine Fisheries Service. The intent of the criteria is to provide the information necessary so that maintenance personnel can set and adjust fish bypass flows to achieve optimum fish bypass conditions at each screening facility.

The operating criteria for the Wapato Screens are provided on pages A.2 through A.5. Text describing the operating criteria appears on pages A.2 through A.3. and a diagram of the Wapato Screens is shown on page A.4. A graph summarizing weir crest height adjustment based on canal surface elevation is shown on page A.5.

The operating criteria for the Chandler Screens are provided on pages A.6 through A.13. Text describing the operating criteria appears on pages A.6 through A.8. Pages A.9 through A.11 describe weir gate adjustments for three ranges of canal water surface elevations. Page A.12 contains a graph showing the appropriate weir crest elevations for a range of canal water surface elevations. Page A.13 shows the appropriate surface levels for controlling flow through the Juvenile Evaluation Building.

The operating criteria for the Easton Screens are provided on pages A.14 through A.16. Text describing the operating criteria appears on pages A.14 and A.15, and a diagram of the Easton Screens is shown on page A.16.

Revised 6/29/87

Operating Criteria
Wapato Canal Fish Screens Bypass System

Operation of the bypass system requires the adjustment of four 2-foot wide bypass overflow weir gates (these are temporarily stoplogs at the present time) located in the fish bypass channels and two S-foot wide excess water overflow gates located behind the pumps in the pumpback structure. These weir gates (or temporary stoplogs) control the quantity of bypass flows and the water surface elevations within the system for good fish passage.

Weir gates (or stoplogs) should be adjusted as follows. Weir gate locations are shown on the attached sketch.

Normal Operation (no pumpback):

1. Adjust crest of weir gates #l, #2, and #3 (or top of temporary stoplogs) to appropriate elevation depending on canal W.S. (water surface) elevation from attached graph. Example: canal W.S. in front of drum screens is at elevation 934.0; set crest of weir gates (stoplogs) to elevation 930.7.

2. Adjust crest of weir gate #4 (or top of temporary stoplogs) to appropriate elevation depending on canal W.S elevation as shown on attached graph. Example; canal W.S elevation 934.0; set crest of #4 weir gate (or top of stoplog) at elevation 928.0.

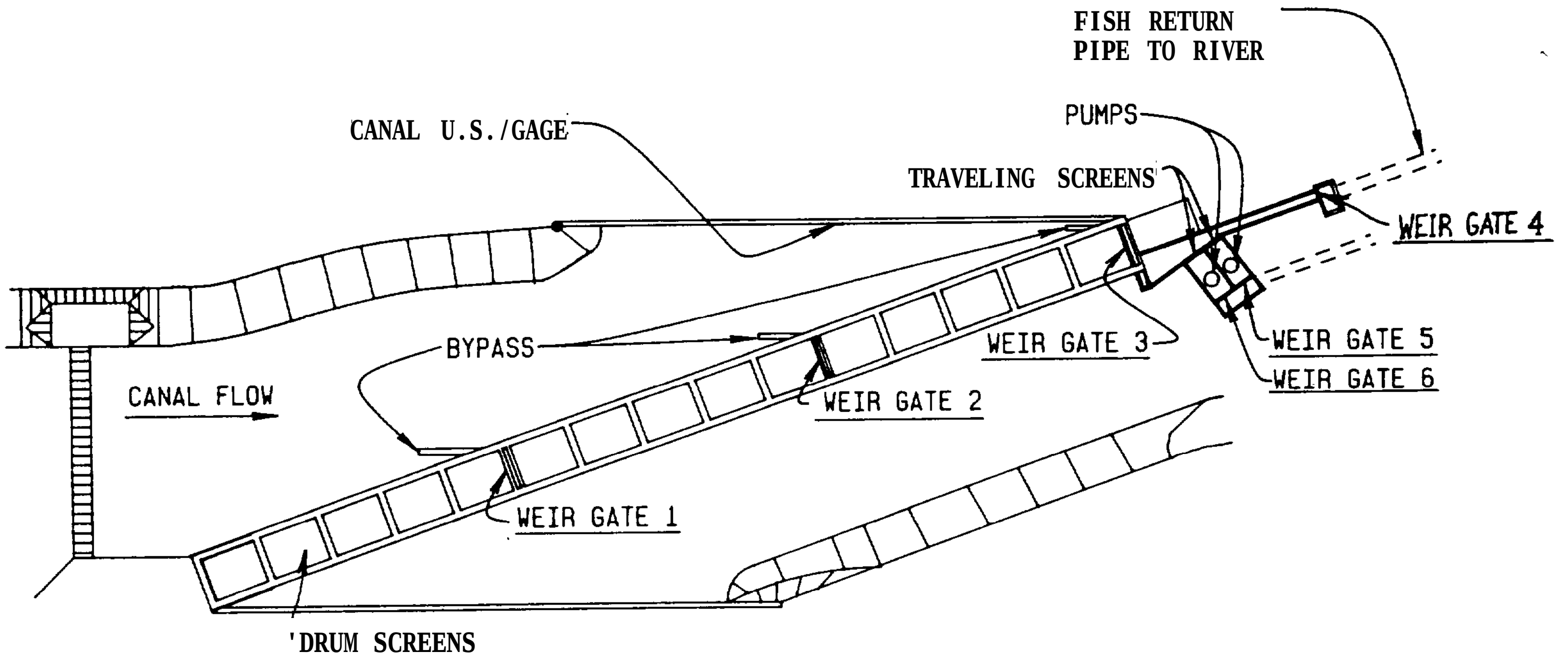
3. Adjust weir gates #5 and #6 "equally" until W.S. elevation in front of traveling screens is 3.5' lower than canal W.S elevation in front of drum screens. Example: canal elevation 934.0: adjust weir gates #5 and #6 equally until W.S. elevation in front of traveling screens is 930.5.

Oweration with Pumwback;

1. Set weir gates #l, #2, #3, and #4 same as for Normal Operation (No Pumpback).

2. With either one or both pumps in operation adjust both weir gates #5 and #6 to maintain the traveling screen W.S. 3.5' lower than canal W.S. elevation. Divide flow through both traveling screens equally.

3. If the difference between the canal W.S. and the traveling screen W.S. is greater than 3.5', even with both weir gates #5 and #6 closed, then lower gates #l, #2, & #3 equally to obtain 3.5' difference. Note: This is very important since for certain conditions the pumps may have enough capacity to pull down the water level in the pumpback structure down too low, drying up the bypass flow over weir gate #4 and resulting in major fish damage.



WAPATO CANAL FISH SCREEN FACILITY PLAN

NATIONAL MARINE FISHERIES SERVICE

WAPATO CANAL FISH SCREEN FACILITY

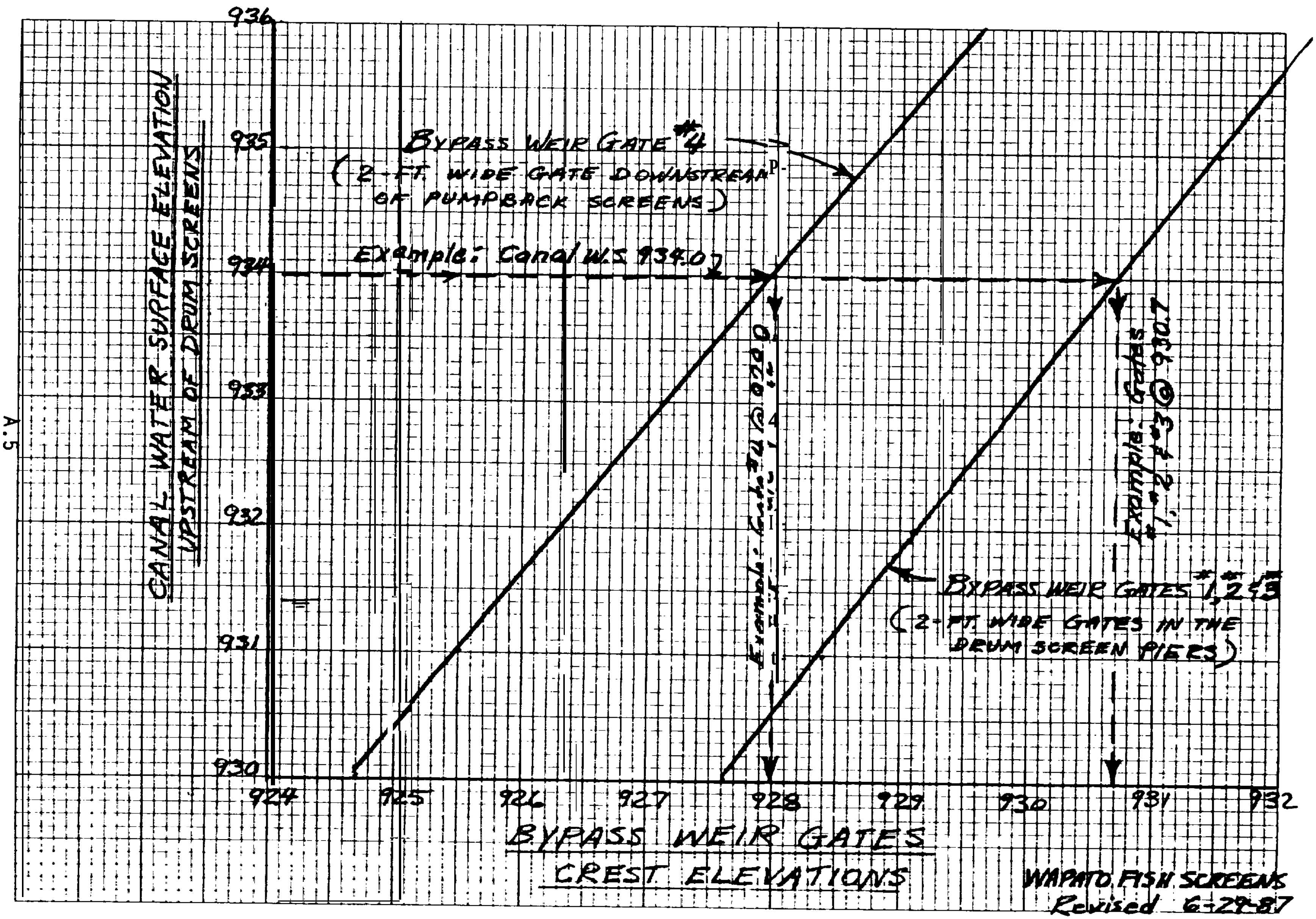
DESIGNED BY: R.P. DATE: 2 - 30 - 87

DRAWN BY: G.A.H. SCALE :

CAD FILE: UAPCAFSF

NO. 340R-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.



OPERATING CRITERIA
CHANDLER SCREENS
3-2-87

1. Check canal water surface elevation.
2. Locate canal water surface on the Weir Gate Operation graph (see the horizontal line). Imagine, or draw lightly, a line upward on the graph from that point. It will intersect the GATE NO. 4 and the GATE NO. 1,2, and 3 lines. Then read horizontally to the left from the point of intersection, and read the required weir crest elevations.
3. Set GATE NO. 4 to the appropriate weir crest setting from the graph.
4. Set GATE NO. 1,2, & 3 to the appropriate setting from the graph.
5. Set the pump structure water surface to the appropriate level:

   PUMPBACK MODE

   Set the 4 pump discharge pipelines so the flow meters each read 25 cfs. Check these readings once every few months of operation.

   GRAVITY MODE

   Hand set each of the two gravity bleed-off gates until the pumpback structure water surface is:

   (For canal water surface of El. 630.9 and higher)-E1.627.8
   (For canal water surface of El. 630.7)-El. 627.6
   (For canal water surface of El. 630.5)-El. 627.3
   (For canal water surface of El. 630.3 and lower)-El. 627.0

   NOTE: When in the gravity bleed-off mode, bleed-off gates should be set at equal openings, which will draw equally through each traveling screen.
6. Checks:

   Check the downwell staff gauge reading for each of the 3 bypass downwells. Remove floating debris. If the bypasses are not impeded, the three bypass downwell readings should be the same (within 0.2'). Check the pump structure bypass downwell reading. It should be at El. 626.0 in order to pass the required flow to the evaluation building.

STANDARD OPERATING PROCEDURES
CHANDLER SCREENS
2-3-87

I. OPERATIONS:

A. NONE-SAMPLING MODE:

1. General

During this mode of operation, bypass flow is being routed directly to the river rather than through the sampled facilities of the juvenile evaluation building.

There are five gates which must be properly set in order for the three main screen and one secondary screen bypasses to function as designed. Gates 1,2, & 3 are the weir gates in the pumpback structure, which control flow in each of the main bypasses. Gate 4 is the weir gate, which controls flow into the secondary bypass and the water surface in the pump structure pool.

Gate 5 is the bulkhead gate in the downwell of the evaluation building, which should be set initially, then not reset until evaluated at a later date.

The settings of Gates l-4 are based on the canal water surface elevation. The attached graph indicates the weir crest elevation (top of weir) that is required for a given canal water surface. After taking the canal water surface reading, set Gates l-4 as indicated on the graph. Be sure to allow a minimum of 10 minutes for flow conditions to reach equilibrium.

2. OPERATIONS AND TROUBLE SHOOTING: Gates l-3

Staff gages are installed to aid in verifying water surface elevations through the system, and for the purpose of identifying when blockages may be inhibiting flow. A staff gage should be located in a forebay location that is easily viewed from the catwalk on the main screen structure. Staff gages should also **be** located on the upstream wall of each of the upwells in the pump structure. Check the differentials from forebay to each upwell. This value should be between 2' and 3', depending on the forebay water surface. There will be surging in the upwell, so take the average reading between high and low surfaces. The IMPORTANT thing is that the differential readings are within **0.3'** of each other. If one reading is more the 0.5' lower than the other two, then the weir gate is improperly set or there is a blockage in one of the bypasses.

3. OPERATIONS AND TROUBLE SHOOTING: Gate 4
   There should also be staff gages in the main pumpback structure pool and the secondary bypass downwell. During normal operating periods, the secondary downwell gage reading should ALWAYS be **626.0.** Adjustment of Gate 4 as indicated on the attached graph should assure the reading.

   The water surface elevation in the pumpback structure pool is controlled **by** the pump discharge (or gravity pipe discharge) and the Gate 4 flow. The pump discharges will be set initially, then left unchanged.

   The water surface elevation in the pumpback structure should be 627.8 at all canal surface elevations above 630.9. Between canal elevations 630.9 and 630.4, the pumpback surface will drop to 627.0. Gate 4 adjustment, as shown on the graph, is necessary to maintain the required bypass flow to the juvenile facility.

B. SAMPLING MODE- Switching to and from:
   In the juvenile evaluation facility upwell, there are two weir gates, which do nothing except control the direction of flow. One should always be fully open and the other should always be closed. The only exception is during switching from one mode of operation to the other. ALWAYS remember that the correct procedure is to open the other gate prior to closing the first gate. Otherwise, the upwell will overtop.

II. MAINTENANCE:

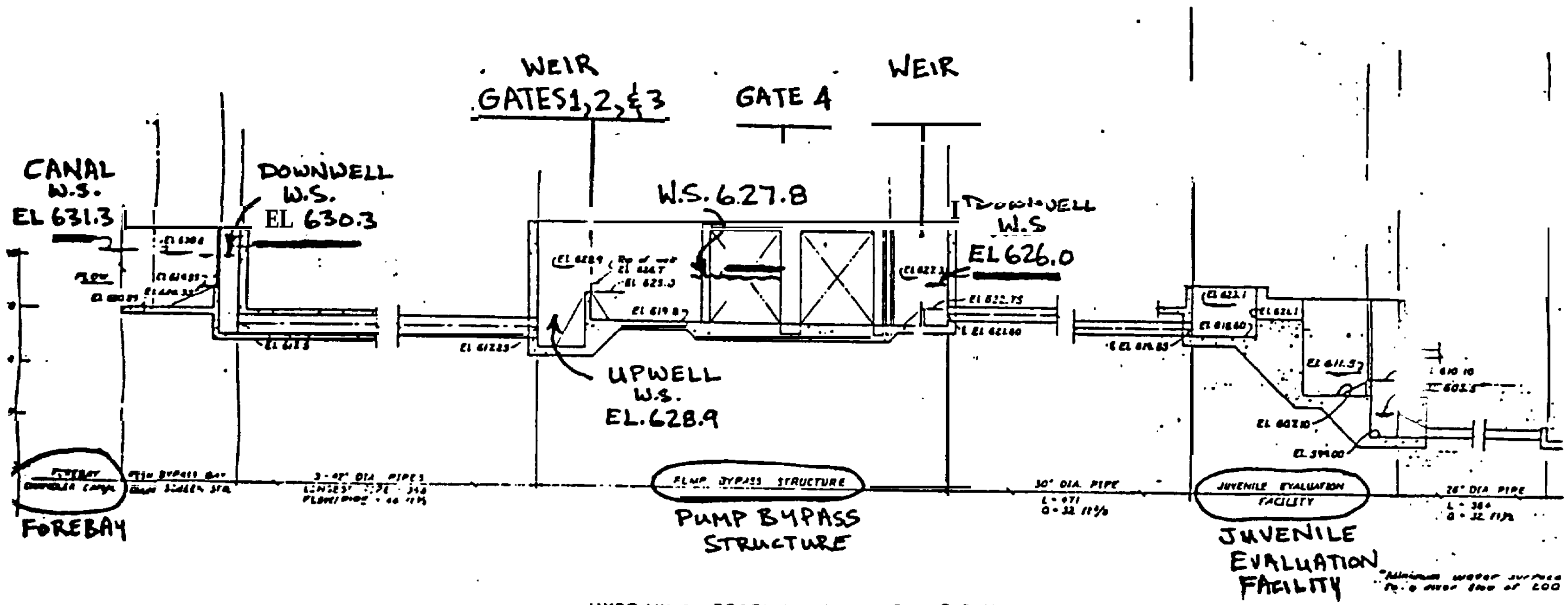
1. Keep all gages clean. They should be readable in order to insure correct operation of the facility.
2. Check all 4 bypasses for accumulations of floating debris. Remove especially debris that may become blocked in the bypasses.

Note: Questions or comments, call Steve Raney. Remember, this is a preliminary set of criteria.

CANAL WATER SURFACE = 631.3

Top of Weir Gates 1, 2, & 3 = EL' 626.7

Top of Weir Gate 4 = EL. 624.85



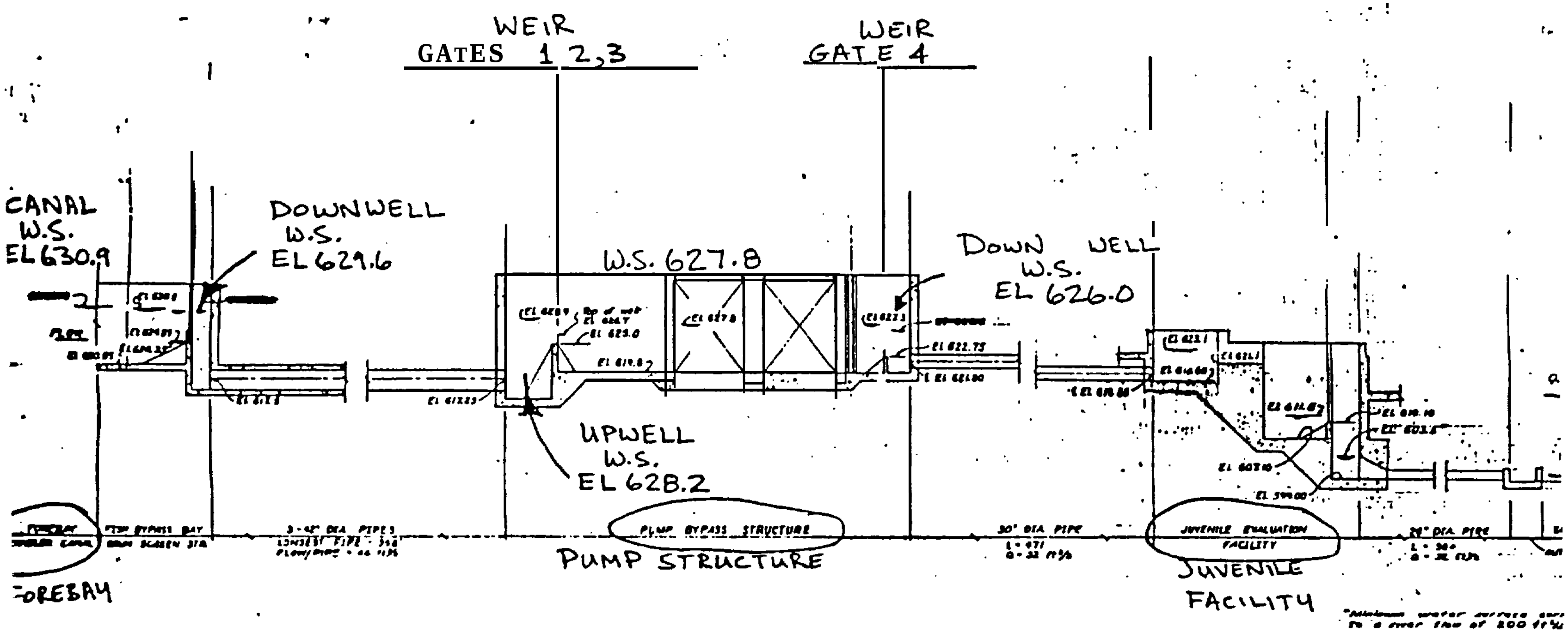
HYDRAULIC PROFILE THROUGH FISH BYPASS FACILITIES
(SCALE 1" = 10')

CANAL WATER SURFACE = 630.9

Top of Weir Gates 1,2,&3 = EL 625.0 (lowest setting)

Top of Weir Gate 4 = EL. 624.85

FLOOD FREQUENCY	FLOW (cfs)	RIVER W.S. EL
	600	[illegible]
	10000	603.3
2 YR.	13300	606.6
[illegible]	21000	611.6
[illegible]	25930	612.7
[illegible]	31900	[illegible]
50 YR	36200	[illegible]
100 YR.	40400	[illegible]

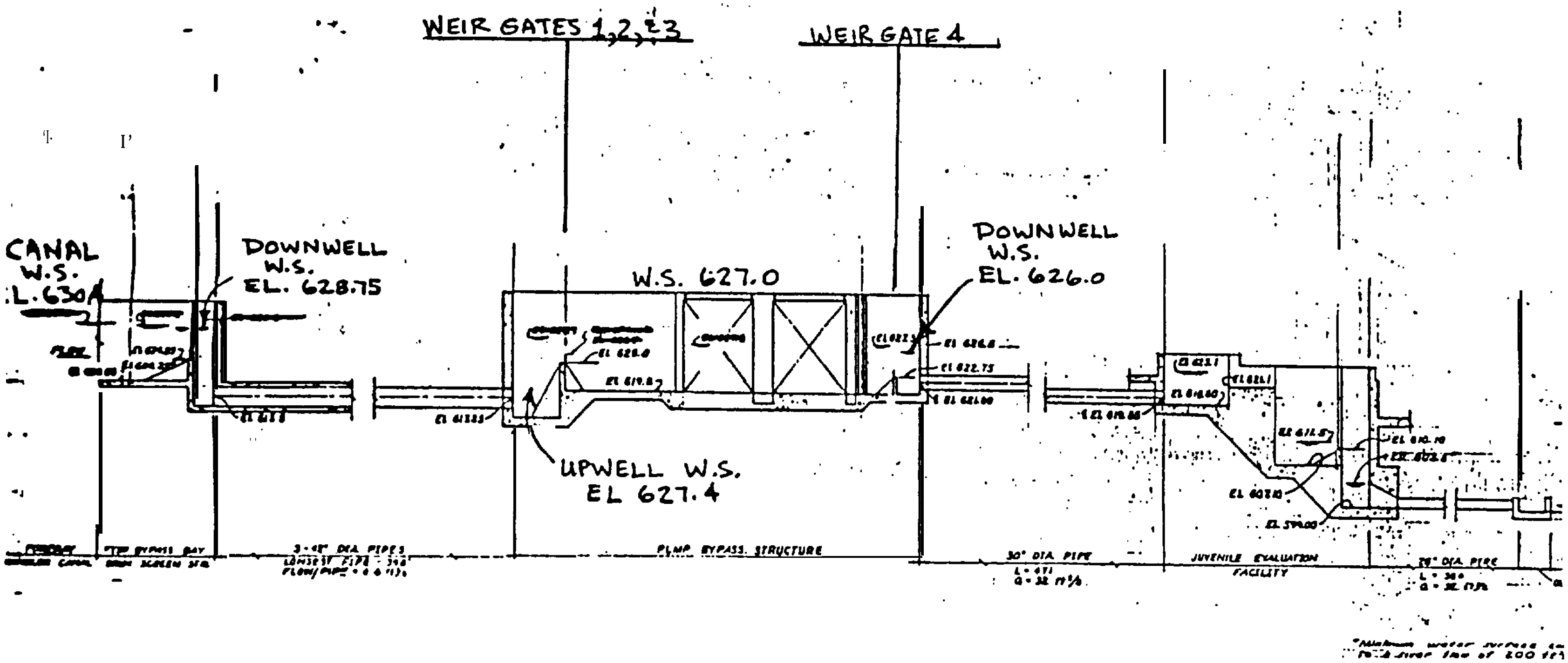


HYDRAULIC PROFILE THROUGH FISH BYPASS FACILITIES (SCALE 1" = 10')

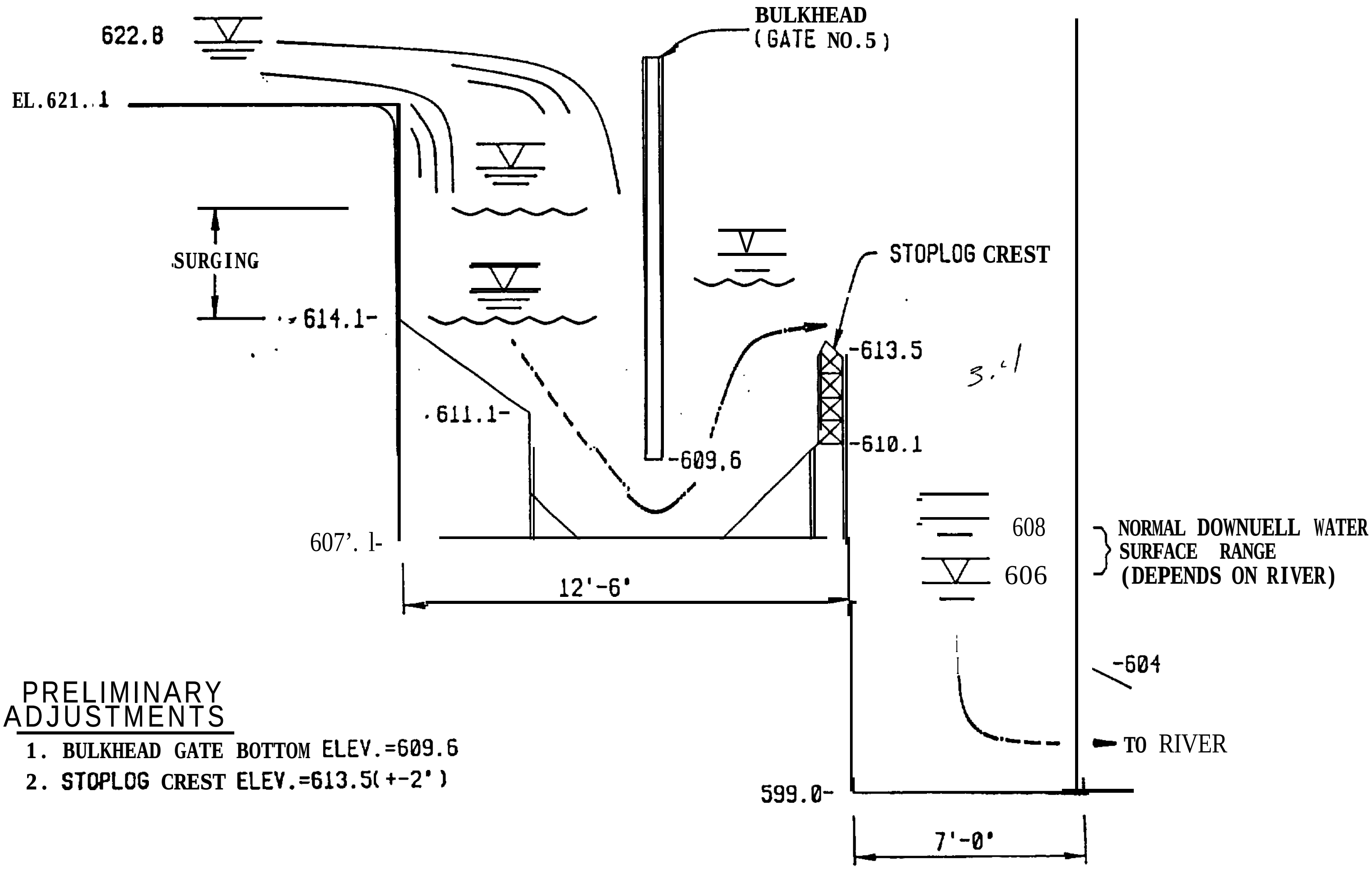
CANAL WATER SURFACE = 630.4

Top of Weir Gates 1, 2, & 3 = EL. 625.0 (lowest setting)

Top of Weir Gate 4 = EL. 622.75 (lowest setting)



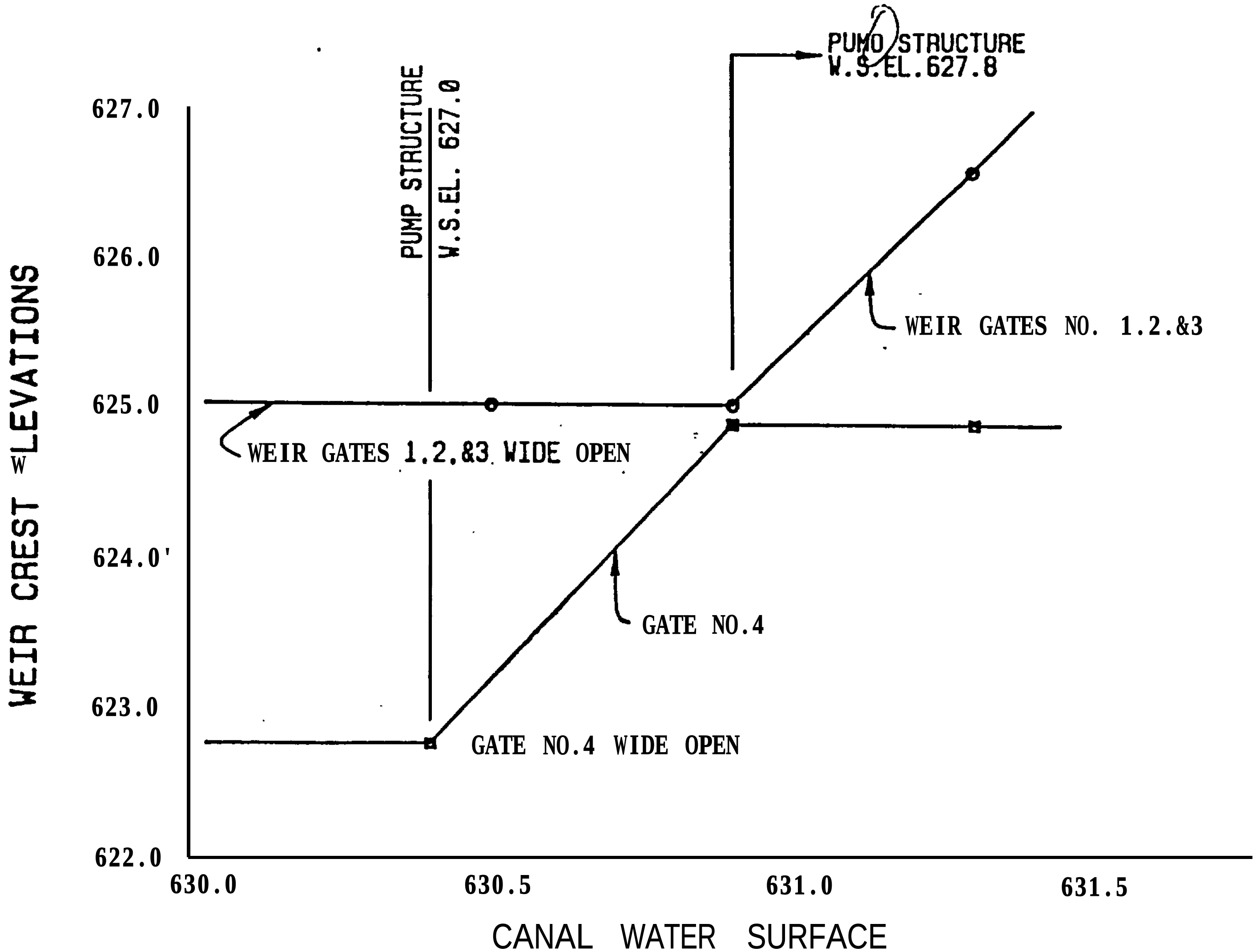
HYDRAULIC PROFILE THROUGH FISH BYPASS FACILITIES
(SCALE 1" = 10')



PRELIMINARY
ADJUSTMENTS

1. BULKHEAD GATE BOTTOM ELEV.=609.6
2. STOPLOG CREST ELEV.=613.5(+-2')

CHANDLER SCREEN
JUVENILE EVALUATION BUILDING
(BYPASS MODE)
BYPASS DOWN .L N.M.F.S. 2-Z-87



GATE NO's 1.2.&3 PASS 44 CFS EACH

GATE NO.4 PASSES 32 CFS

CHANDLER SCREEN

WEIR GATE OPERATION

N.M.F.S. 2-3-87

A.13

KITTITAS CANAL SCREEN/BYPASS OPERATING CRITERIA
(NMFS - 7/6/89)

Comments on screen and bypass operation:

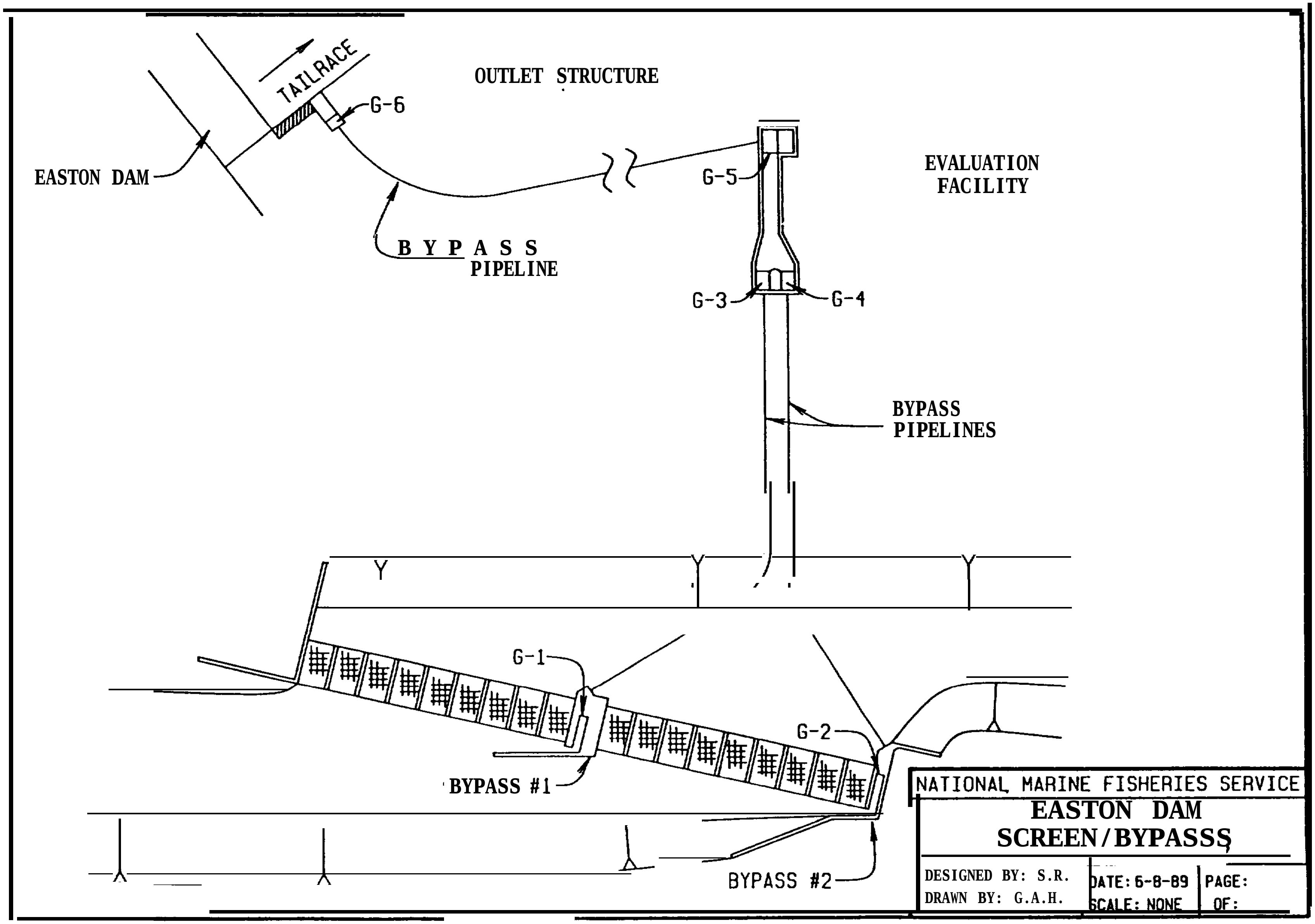
1. There is no canal water surface elevation (WS) control structure to maintain screen submergence.
2. The bypass design flow is 80 cfs. The system is designed to pass 80 cfs even at low canal WS elevations.
3. During periods of minimum stream releases past Easton, total bypass flow should not be reduced below 40 cfs.
4. Based on the need for coordinating adult and juvenile passage facilities flow releases, relative to the Bureau's Easton gage reading, the correct mode of operation during low streamflow periods is based on the June 15 date. Prior to that date, juvenile passage is emphasized; after June 14, adult passage is emphasized.
5. Bureau miscellaneaous flows at the dam equal 15 cfs ±. These are not considered below, but do take priority.

PRIOR TO JUNE 15: (Emphasis - juvenile passage)

1. Easton Gage reading less than 105 cfs:
   Bypass flow = (Easton gage flow) - (Easton ladder flow of 28 cfs)
   Set gates G-l and G-2 5.0 feet **below** the canal WS.
   Set Gates G-3 and G-4 as follows:
   If bypass flow to be 40 cfs, set weir gate crest 1.3 ft. below upwell WS.
   If bypass flow to increase from 40 to 80 cfs, increase weir gate crest submergence incrementally from 1.3 to 2.1 ft. below upwell WS.
   Set gate G-5 at the following crest elevation:
      If canal WS is above el. 2175: crest el. = 2169.0
      If canal WS is below el. 2175: set gate at lowest setting.
   Set gate G-6 at crest elevation 2162.0.
2. Easton Gage reading greater than 105 cfs:
   Set Gates G-l and G-2 5.0 feet below canal water surface.
   If bypass flow to **be** between 40 and 80 cfs, increase weir gate crest submergence incrementally from 1.3 to 2.1 ft. below upwell WS.
   Set gate G-5 at the following crest elevation:
      If canal WS is above el. 2175: crest el. = 2169.0
      If canal WS is below el. 2175: set gate at lowest setting.
   Set gate G-6 at crest elevation 2160.9.

AFTER JUNE 14: (Emphasis - adult passage)

1. Easton Gage reading less than 160 cfs:
   Gates G-l and G-2 set at 5.0 feet below the canal water surface elevation.
   Gates G-3 and G-4 set at 1.3 ft. below upwell water surface (40 cfs).
   Remaining flow through fish ladder (up to 120 cfs).
   Set gate G-5 at the following crest elevation:
   If canal WS is **above** el. 2175: crest el. = 2169.0
   If canal WS is below el. 2175: set gate at lowest setting.
   Gate G-6 set at crest elevation 2162.0.
2. Easton Gage reading greater than 160 cfs:
   Gates G-l and G-2 set at 5.0 feet below the canal water surface elevation.
   Gates G-3 and G-4 set for bypass flow between 40 and **80** cfs: Increase G-3 and G-4 wier crest submergence below upwell WS incrementally from 1.3 to 2.1 ft.
   Set gate G-5 at the following crest elevation:
   If canal WS is above el. 2175: crest el. = 2169.0
   If canal WS is below el. 2175: set gate at lowest setting.
   Gate G-6 set at crest elevation 2160.9.


OUTLET STRUCTURE
TAILRACE
G-6
EASTON DAM
BYPASS PIPELINE
G-5
EVALUATION FACILITY
G-3
G-4
BYPASS PIPELINES
G-1
G-2
BYPASS #1
BYPASS #2
NATIONAL MARINE FISHERIES SERVICE
EASTON DAM
SCREEN/BYPASSS
DESIGNED BY: S.R.
DRAWN BY: G.A.H.
DATE: 6-8-89
SCALE: NONE
PAGE:
OF:

APPENDIX B

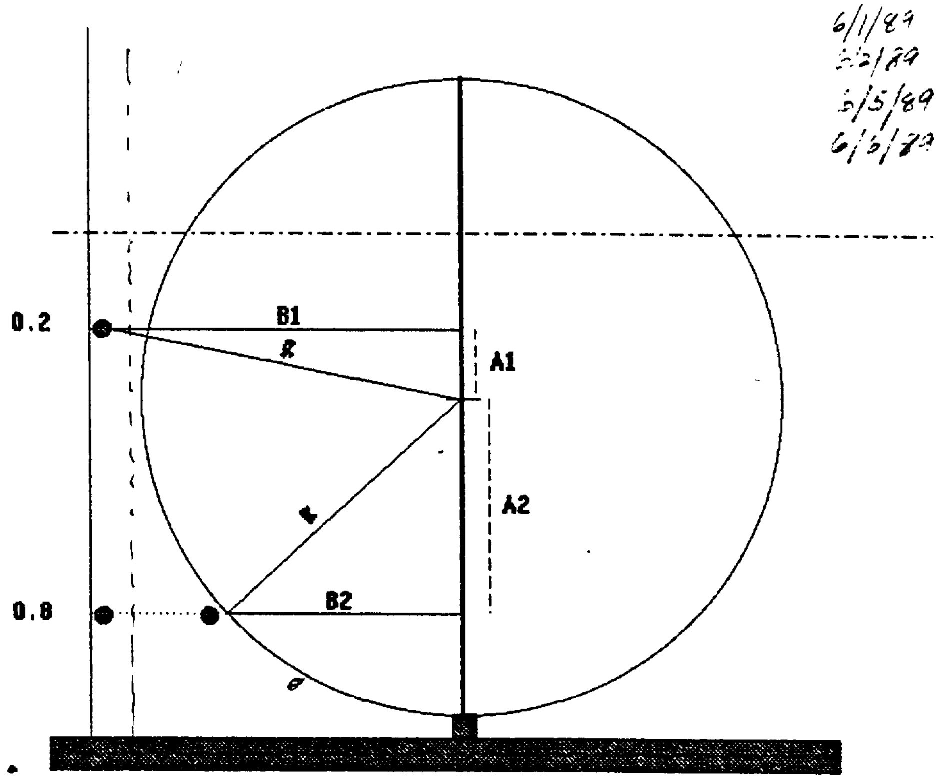
WAPATO SCREENS RAW DATA SHEETS

APPENDIX B

WAPATO SCREENS RAW DATA SHEETS

This appendix contains the raw data sheets for flow measurements taken at the Wapato Screens on June 1 and 2 and June 5 and 6, 1989. Page B.2 shows the calculations made to position probes at the proper depths and the distance between the probe and the screen face at each depth. Raw data for measurements taken before the Yakima Indian Nation salmon rearing pens were removed from the forebay are presented on pages 8.3 through 8.20. Raw data for measurements taken after the rearing pens were removed from the forebay are presented on pages 8.21 through B.38.

Wapato
6/1/89 934.9' El.
6/2/89 934.9'
6/5/89 934.85'
6/6/89 934.85'



Drum Diameter (D): 168
Radius (R): 84
Exposed to Air (E): 36
Submerged (Z): 132

	Side A	Side B
0.2 Z: 26.4	A1= R-(E+0.2 Z) 21.6	B1= $(R^2-A1^2)^{0.5}$ 81.18
0.8 Z: 105.6	A2= R-(E+0.8 Z) 57.6	B2= $(R^2-A2^2)^{0.5}$ 61.14

Distance From Vertical to Screen Face

0.2 Z: R-B1= 2.82"

0.8 Z: R-B2= 22.86"

Note: same measurement depths were used for series on 6/5- 6/1/89, despite the canal elevation being 0.05' lower — lsa

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140"
Screen Diameter (in.) 168"
Screen Exposed (in.) 36"
Screen # I   Screen Submerged (in.) 132"

Date: 6-1-89
Personnel: CSA / DOD

	6-1				6-2			
Time Start	1601		1601		1017		1017	
Time End	1605		1605		1020		1020	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	-A	S	-A
1	0.6	-0.3	1.8	0.8	1.2	-0.6	0.9	-0.4
2	0.9	0.2	1.8	1.1	2.0	-0.5	1.5	-0.8
3	1.3	0.9	1.1	-0.6	2.2	-0.6	1.5	-0.5
4	0.8	-0.1	1.3	0.2	1.9	-0.8	1.5	-1.2
5	0.8	0.1	2.0	1.3	1.4	-0.5	1.4	-1.0
6	0.7	0	1.7	0.7	1.7	-0.7	1.1	-0.9
7	1.0	0.4	1.6	1.0	1.0	-0.7	1.0	-0.8
8	0.9	0	1.9	0.6	1.2	-0.9	1.1	-0.8
9	1.0	0.5	1.4	0.7	1.4	-0.9	1.3	-0.8
10	0.8	-0.2	1.2	0.2	1.3	-0.8	1.2	-0.5
Average	0.88	0.15	1.58	0.60	1.53	0.73	1.25	0.77
Minimum	0.6	-0.3	1.1	-0.6	1.0	0.5	0.9	0.4
Maximum	1.3	0.9	2.0	1.3	2.2	0.9	1.5	1.2

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140"
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 2 Screen Submerged (in.) 132

Date: 6-1-89
Personnel: CSA | DDD

	2-1				2-2			
Time Start	1552		1552		1006		1006	
Time End	1555		1555					
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	-A	S	-A
1	1.2	0.2	1.5	0.5	1.8	-0.5	1.0	-0.2
2	1.4	0.3	1.8	0.5	1.6	-0.4	1.3	0.5
3	1.0	0.2	1.8	0.6	1.8	-0.5	1.2	-0.2
4	1.4	0.3	1.7	0.7	1.3	-0.5	1.4	-0.4
5	1.3	0.4	1.6	0.9	1.8	-0.4	1.7	-0.2
6	1.1	0.2	1.4	0.3	1.6	-0.7	1.0	-1.5
7	1.1	0.2	1.6	0.4	2.0	-0.8	1.4	-2.0
8	1.2	0.2	1.9	0.2	2.5	-0.5	1.6	0.6
9	1.0	0.2	1.7	0.2	1.7	-0.4	1.6	+0.4
10	1.2	0.3	1.8	0.6	2.0	-0.7	1.8	0.2
Average	1.19	0.25	1.68	0.49	1.81	0.54	1.40	0.28
Minimum	1.0	0 2	1.4	0.2	1.3	0.4	1.0	-0.6
Maximum	1.	0.4	1.9	0.9	2.5	0.8	1.8	2.0

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140 "
Screen Diameter (in.) 16f "
Screen Exposed (in.) 36
Screen # 3 Screen Submerged (in.) 162 "

Date: 6 - r-6-Q
Personnel: CSA / DDO

6 · 1 | 6 2

Time Start	1537		1537		958		958	
Time End	1541		1541		1001		1001	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	– A	S	– A
1	1.7	0.2	1.6	0.5	1.7	-0 4	1.5	-0.5
2	1.7	0.3	2.0	0.6	2.4	-1.2	1.4	-0.9
3	1.6	0.2	1.6	0.5	1.3	-0 7	1.1	-0.2
4	2.2	0.8	1.5	-0.6	0.6	-0.5	2.1	-1.0
5	1.7	0.3	1.6	-0.4	0.8	-0.4	2.0	-0.7
6	1.1	-0.4	2.6	1.9	3.4	-1.2	0.9	0.8
7	1.3	0.4	1.4	-1.3	3.6	-1.0	0 7	1.3
8	1.4	0.1	1.8	2.3	1.6	-0.4	1.8	-0.3
9	1.0	-0.6	1.4	0.5	2.2	-0 9	1 0	-2.4
10	1.5	0.2	1.9	1.7	2.7	-0.4	1.4	-0.3
Average	1.52	0.15	1.74	0.57	2.03	0.71	1.39	0.42
Minimum	1.0	-0.6	1.4	-1.3	0.6	0.4	0.7	-1.3
Maximum	2.2	0.8	2.6	2.3	3.4	1.2	2.1	2.4

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.1 140"
Screen Diameter (in.) 168"
Screen Exposed (in.) 36"
Screen # 4 Screen Submerged (in.) 132"

Date: 6-1-89
Personnel: CEA/DDD

Time Start	1528		1528		945		945	
Time End	1532		1532		948		948	
Oepth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	- A	S	- A
1	1.8	0.3	1.9	-0.4	2.1	-0.6	1.4	-1.7
2	1.7	0.3	2.1	2.3	2.0	-0.6	1.9	-0.5
3	,	0.3	1.8	0.2	2.2	-0.2	1.5	-0.4
4	1.8	0.3	2.1	2.2	2.0	-0.6	1.9	-0.2
5	1.7	0.2	1.6	0.3	2.5	-0.6	1.8	-0.7
6	1.9	0.5	1.9	1.1	2.6	-0.7	1.6	0.3
7	1.8	0.2	2.0	1.7	2.1	-0.2	1.7	-0.1
8	1.6	0.2	1.8	0.4	2.3	-0.7	1.7	0.8
9	1.8	0.3	2.1	0.9	2.3	-0.8	1.4	-0.9
10	1.7	0.3	2.0	1.9	3.0	-1.1	1.6	-1.4
Average	1.74	0.29	1.93	1.06	2.31	0.61	1.65	0.48
Minimum	1.6	0.2	1.6	-0.4	2.0	0.2	1.4	-0.3
Maximum	1.9	0.5	2.1	2.3	3.0	1.1	1.9	1.7

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140"
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen #5 Screen Submerged (in.) 132

Date: 6-1-89
Personnel: CSA/DDD

	6-1		6-1		6-2		6-2	
Time Start	1521		1521		937		937	
Time End	1524		1524		940		940	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	-A	S	-A
1	1.9	0.2	2.0	0.9	2.3	-0.3	1.4	-0.2
2	1.9	6.3	2.3	0.5	2.2	-0.7	1.7	-0.9
3	1.8	0.3	1.3	-1.4	2.2	-0.8	1.6	-0.4
4	2.0	0 3	2.4	1.2	2.1	-0.4	1.8	0
5	1.8	0 2	1.9	0.2	0.8	-0 3	1.3	-0.8
6	1.9	0.2	2.2	-0.4	2.0	-0.7	1.3	-1.2
7	1.8	0 3	2.4	1.8	1.3	-0.6	1.8	1.2
8	1.7	0.3	1.8	-0.6	2.1	-1.1	1.7	0.8
9	1.6	0.3	2.5	1.0	2.3	-1 1	2 1	-0.5
10	1.7	0.3	1.8	0	1.6	-0 4	1.1	-1.2
Average	1.81	0.27	2.06	0.32	1.91	0.64	1.58	0.32
Minimum	1.6	0.2	1.3	-1.4	0.8	0.3	1.3	-1.2
Maximum	2.0	0.3	2.5	1.8	2.3	1.1	2.1	1.2

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 6 Screen Submerged (in.) 132

Date: 6-1-89
Personnel: CSA | DOD

	6-1		6-1		6-2		6-2	
Time Start	1500		1500		928		928	
Time End	1503		1503		932		932	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	- A	S	- A
1	1.2	0.1	1.5	0.6	1.4	-0.5	0.9	-0.6
2	1.3	0.2	1.5	0.5	1.3	-0.5	1.0	-0.4
3	1.3	0.2	1.4	0.6	1.2	-0.4	1.1	-0.6
4	1.2	0.1	1.6	0.5	1.1	-0.3	1.1	-0.4
5	1.0	0.2	1.4	0.4	1.3	-0.2	1.0	-0.6
6	1.2	0.1	1.6	0.4	1.3	-0.4	1.0	-0.9
7	1.2	0.1	1.5	0.5	1.2	-0.4	0.9	0.1
8	1.3	0.2	1.5	0.7	1.0	-0.4	1.0	-0.3
9	1.1	0.1	1.4	0.5	1.3	-0.5	0.9	-0.3
10	1.2	0.1	1.4	1.3	1.1	-0.5	0.9	-0.5
Average	1.20	0.14	1.48	0.60	1.22	0.41	0.98	0.45
Minimum	1.0	0.1	1.4	0.4	1.0	0.2	0.9	-0.1
Maximum	1.3	0.2	1.6	1.3	1.4	0.5	1.1	0.9

Notes:

6-1/2 - S top plugged totally

- Screen not turning and plugged

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 148
Screen Exposed (in.) 36
Screen # 7 Screen Submerged (in.) 132

Date: 6-1-89
Personnel: CSA / DDD

	6-1				6.2			
Time Start	1452		1452		919		919	
Time End	1456		1456		922		922	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	- A	S	- A
1	1.5	0.3	1.5	-0.4	1.7	-1.2	1.6	-1.3
2	1.5	0.2	1.9	1.7	2.2	-0.9	1.9	-0.2
3	1.6	0.3	1.6	0.9	1.6	-0.5	1.4	-0.8
4	1.7	0.4	1.8	0.6	1.8	-0.5	.4	-0.4
5	1.5	0.2	1.8	1.1	1.7	-0.6	1.7	-0.5
6	1.6	0.3	1.7	-0.4	2.0	-0.9	1.7	-0.2
7	-1.4	0.7	1.0	-2.2	1.	-1.0	1.2	-0.6
8	1.6	0.3	1.6	-0.3	1.8	0	1.5	0.1
9	1.5	0.2	1.2	-1.1	2.0	-0.7	1.4	0.4
10	1.6	0.3	1.4	0.3	1.9	-0.5	1.3	-0.6
Average	1.55	0.28	1.55	0.02	1.85	0.68	1.53	0.38
Minimum	1.4	0.2	1.0	-2.2	1.6	0.0	1.3	-0.4
Maximum	1.7	0.4	1.9	1.7	2.2	1.2	1.9	1.0

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 8 Screen Submerged (in.) 132

Date: 6-1-89
Personnel: CSA/BDD

6-1 | 6-2

	6-1		6-1		6-2		6-2	
Time Start	1314		1314		911		911	
Time End	1317		1317		914		914	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	– A	S	– A
1	1.7	a 4	2.0	0.2	1.3	-0.9	1.7	1.3
2	1.7	0.3	2.5	2.2	1.6	-0.6	1.3	-0.1
3	1.7	0.2	2.1	1.9	1.1	-0.5	1.3	-0.3
4	1.7	0.4	1.8	0.9	1.8	-0.4	1.5	-0.8
5	1.8	0.4	1.8	0.1	1.7	-0.5	1.5	0.9
6	1.7	0.2	2.3	2.9	1.1	0	1.4	-0.4
7	1.6	0.4	1.4	1.7	1.9	-0.9	1.6	-0.2
8	1.7	0.3	1.4	-0.7	1.9	-0.7	1.4	-0.8
9	1.6	0.3	1.3	-0.4	1.3	-0.7	1.3	0.1
10	1.8	0.3	1.6	0.3	1.4	-0.8	1.6	-0.6
Average	1.70	0.32	1.84	0.91	1.51	0.60	1.46	0.17
Minimum	1.6	0.2	1.3	-0.7	1.1	0.0	1.3	-1.3
Maximum	1.8	0.4	2.5	2.9	1.9	0.9	1.7	0.9

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 9 Screen Submerged (in.) 132

Date: 6-1-89
Personnel: CSA/DPO

Time Start	1303		1303		855		855	
Time End	1307		1307		900		900	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	- A	S	- A
1	1.6	0.4	1.7	0.8	2.0	-1.0	1.4	0.5
2	1.6	0.3	1.7	2.8	1.2	-0.7	0.9	0.6
3	1.6	0.2	2.0	-1.4	1.1	-0.5	1.0	-0.9
4	1.7	0.4	2.6	2.1	2.1	-0.6	1.2	-0.4
5	1.7	0.3	1.4	-0.7	1.5	-0.5	1.5	1.3
6	1.6	0.3	1.4	-0.7	1.8	-1.0	1.1	-1.6
7	1.6	0.3	1.4	0.9	1.7	-0.6	1.1	-0.5
8	1.7	0.2	2.7	3.1	1.9	-1.5	1.1	-0.3
9	1.6	0.3	2.1	1.4	1.1	-0.6	1.0	-1.4
10	1.6	0.	2.0	2.4	1.7	-0.9	1.0	-0.4
Average	1.62	0.30	1.90	1.07	1.61	0.83	1.15	0.21
Minimum	1.6	0.2	1.4	-1.4	1.1	0.5	0.9	-1.3
Maximum	1.7	0.4	2.7	3.1	2.1	1.5	1.5	1.4

Notes:

Wapato Screening Facility Flow Measurements

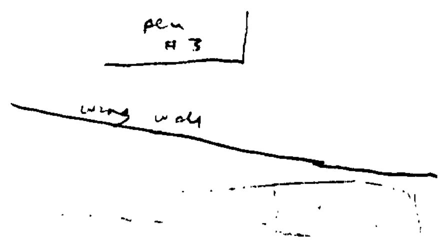
Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 10 Screen Submerged (in.) 132

Date: 6-1-89
Personnel: CSA / DOD

	6-1				6-2			
Time Start	1254		1254		848		848	
Time End	1257		1257		851		851	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	− A	S	− A
1	1.6	0.3	2.1	1.4	1.5	−0.1	1.2	−0.5
2	1.7	0.4	2.0	1.5	1.9	−0.4	1.0	0
3	1.6	0.3	1.3	−1.4	2.0	−0.3	1.1	−1.3
4	1.7	0.4	1.9	0.6	1.2	−0.3	1.0	−1.4
5	1.5	0.2	1.7	1.8	1.9	−0.6	1.2	−1.2
6	1.4	0.2	0.3	−2.4	1.7	−0.8	1.4	−1.6
7	1.6	0.3	1.5	0.6	2.2	−0.9	1.1	0.5
8	1.7	0.5	1.8	1.2	1.8	−0.3	1.1	−0.2
9	1.5	0.3	1.1	−0.8	1.5	−0.7	1.3	−0.4
10	1.5	0.3	1.6	−1.4	2.5	−1.6	1.2	−1.3
Average	1.58	0.32	1.53	0.11	1.77	0.60	1.16	[illegible]
Minimum	1.4	0.2	0.3	−2.4	1.2	0.1	1.0	−0.5
Maximum	1	0.5	2.1	1.8	2.5	1.6	1.4	1.6

Notes:

center of screen perpendicular to 1st corner of net pen #2



Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 11 Screen Submerged (in.) 132

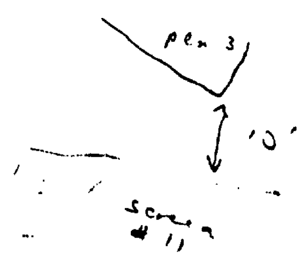
Date: 6-1-89
Personnel: CSA) DDO

	6-1		6-1		6-2		6-2	
Time Start	1231		1231		840		840	
Time End	1235		1235		843		843	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	– A	S	– A
1	1.3	0.2	1.6	0.4	1.1	-0.2	1.0	-0.2
2	1.4	0.1	1.4	0.6	1.3	-0.4	0.9	-0.3
3	1.4	0.1	1.5	-0.9	1.2	-0.7	0.9	0
4	1.4	0.2	2.0	1.1	1.1	-0.2	0.7	-0.7
5	1.3	0.1	1.6	0.1	1.3	-0.3	1.3	0.1
6	1.3	0	1.7	0.5	1.4	-0.4	0.9	-1.0
7	1.3	0.1	1.5	0.4	1.1	-0.2	0.9	-0.7
8	1.3	0.2	1.6	0.2	1.3	-0.1	1.1	-0.1
9	1.3	0.1	1.5	0.4	1.3	-0.4	1.0	-0.3
10	1.2	0	1.6	0.1	1.5	-0.3	0.9	-0.7
Average	1.32	0.1	1.60	0.29	1.26	0.28	0.96	0.37
Minimum	1.2	0	1.4	-0.9	1.1	0.1	0.7	-0.1
Maximum	1.4	0.2	2.0	1.1	1.5	0.4	1.3	0.7

Notes:

6/1-2 screen not turning and plugged.

- lower corner of pen # 3 (downstream pen) is just downstream of the screen centerline, ~10' from screen face



Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 1 ?0
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 12 Screen Submerged (in.) 132

Date: 6- I-P?
Personnel: CFA/DDO

	6 - I	6 - I	6 - 2	6 - 2
Time Start	1219	1219	832	832
Time End	1223	1223	835	835

Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	- A	S	- A
1	1.6	0.4	2.8	1.4	1.3	-0.2	1.4	0.7
2	1.7	0.4	1.7	1.0	1.3	-0 2	0.9	-0 6
3	1.6	0 4	1.4	-1.2	1 4	-0.1	1.2	0.1
4	1.6	0.4	0.9	-0..3	2.1	-0 7	1.2	0.4
5	1 7	0.4	1.8	-1.5	2 1	-0.9	1 2	-0.2
6	1.5	0.3	2.2	1.4	2.0	-0.5	1.0	-0.2
7	1.5	0.3	1.8	1.4	1.9	-0.6	1.3	-0 2
8	1.6	0.3	2.2	-3.6	1.6	-0.8	1.1	-0.4
9	1.6	0.4	1.0	--4.3	2.1	-0.5	1.3	-0.2.
10	1.6	0.3	2.8	3.2	1.6	-0.2	1.0	-0.4

Average	1.60	0.36	1.86	-0.25	1.74	0.47	1.16	0.1
Minimum	1 5	0.3	0.9	-4.3	1.3	0.1	0.9	-0.7
Maximum	1.7	0 3	2.5	3.2	2 1	0.9	1 4	0.6

Notes:

6-f extreme variability in approach velocity at 0.8 ?

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen #13 Submerged (in.) 132

Date: C-I-S?
Personnel: CSA / DDD

6 - I

b - 2

	0.2		0.8		0.8a		0.8	
Time Start	1209		1209		822		822	
Time End	1213		1213		827		827	
Vector	S	A	S	A	S	- A	S	- A
1	1.2	0.4	1.6	0.1	1.8	-0.8	1.2	-0.6
2	0.8	0.2	1.8	0.4	1.8	-0.5	1.1	-0.4
3	0.9	0.4	1.7	0.5	1.7	-0.5	1.1	-0.4
4	0.8	0.4	2.0	0.7	1.6	-0.6	1.2	-0.4
5	1.1	0.3	1.6	0.7	1.8	-0.4	1.2	-0.3
6	0.8	0.3	1.6	0.8	1.5	-0.3	1.4	+0.5
7	1.0	0.4	1.7	-0.8	1.9	-0.6	1.1	-0.9
8	0.9	0.2	1.9	0.3	1.7	-0.4	1.1	-1.3
9	0.9	0.2	1.2	-0.7	1.4	-0.6	1.2	+0.2
10	1.0	0.3	1.6	0.8	1.9	-0.8	1.0	-0.4
Average	.94	0.31	1.67	0.28	1.71	0.55	1.16	0.40
Minimum	0.8	0.2	1.2	-0.8	1.4	0.3	1.0	-0.5
Maximum	1.2	0.4	2.0	0.8	1.9	0.8	1.4	1.3

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 14 Screen Submerged (in.) 132

Date: 6-1-89
Personnel: CSA / DDD

	6-1				6-2			
Time Start	1200		1200		813		813	
Time End	1203		1203		816		816	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	- A	S	- A
1	1.2	0.3	1.2	0.8	1.4	-0.3	0.8	-0.4
2	1.2	0.3	1.3	0.5	1.5	-0.6	0.9	-0.3
3	1.2	0.3	1.3	0.6	1.2	-0.4	0.9	0.1
4	1.0	0.4	1.3	0.2	1.3	-0.5	0.9	-0.2
5	1.1	0.3	1.3	0.6	1.2	-0.4	0.9	-0.8
6	1.1	0.3	1.5	0.8	1.1	-0.4	0.8	-0.6
7	1.0	0.4	1.4	0.9	1.3	-0.6	0.8	-0.5
8	0.9	0.3	1.3	0	1.3	-0.4	0.9	-0.5
9	1.0	0.3	1.6	0.9	1.6	-0.7	1.1	-0.3
10	1.0	0.3	1.7	1.3	1.0	-0.4	0.8	-0.5
Average	1.07	0.32	1.39	0.66	1.29	0.47	0.88	0.42
Minimum	0.1	0.3	1.2	0	1.0	0.3	0.8	-0.1
Maximum	1.2	0.4	1.7	1.3	1.6	0.7	1.1	0.8

Notes: Same vector or #15

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140 Date: 6-1-89
Screen Diameter (in.) 168 Personnel: CSA/DDD
Screen Exposed (in.) 36
Screen # 15 Screen Submerged (in.) 132

6-1 6-2

Time Start	1142	1142	803	803
Time End	1145	1145	806	806

Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	−A	S	−A
1	0.9	0.4	1.0	0.4	1.1	−0.8	0.4	−0.8
2	0.9	0.4	1.1	0.7	1.2	−0.7	0.8	−0.9
3	0.8	0.4	1.1	0.6	1.2	−0.8	0.7	−0.6
4	0.9	0.3	1.0	0.8	1.4	−0.6	0.6	−0.7
5	0.8	0.3	1.2	1.8	1.2	−0.7	0.7	−0.9
6	0.8	0.3	1.0	0.7	1.1	−0.8	0.7	−0.8
7	0.8	0.4	1.0	0.8	1.2	−0.6	0.6	−1.1
8	0.8	0.3	0.8	0.4	1.1	−0.7	0.7	−0.8
9	1.0	0.4	0.9	0.3	1.4	−0.8	0.8	−0.9
10	0.9	0.5	1.0	0.6	1.2	−0.7	0.7	−1.0

Average	0.86	0.37	1.01	0.71	1.21	0.74	0.67	0.75
Minimum	0.8	0.3	0.8	0.3	1.1	0.6	0.4	0.6
Maximum	1.0	0.5	1.2	1.8	1.4	0.8	0.8	1.1

Notes:
6/1/89 +x = ~~approach~~ sweep, for all 15 screens
+y = approach

6/2/89 0.8 Sweep = +x } Unit 824 for all 15 screens
0.8 Approach = −y }

0.8a Sweep = +y } Unit 1020
0.8a Approach = −x }

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen Submerged (in.) 132

Screen # Bypass #1

Date: k-1-89
Personnel: CSA1DDD

Time Start	1510	1510					
Time End	1514	1514					

Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	A	S	A
1	1.6	0.1	1.5	-0.7				
2	1.5	0.1	1.5	-0.3				
3	1.5	0.3	1.6	-0.2				
4	1.4	-0.2	1.6	-0.3				
5	1.6	0.1	1.6	-0.5				
6	1.6	-0.4	1.5	-0.5				
7	1.6	-0.3	1.5	-0.8				
8	1.6	-0.1	1.6	-0.3				
9	1.6	0.1	1.5	-0.4				
10	1.7	-0.3	1.7	0.2				
Average	1.57	-0.06	1.56	0.38				
Minimum		-0.4	1.5	-0.8				
Maximum	1.7	0.2	1.	0.2				

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 1166
Screen Exposed (in.) 36
Screen Submerged (in.) 132
Screen # bypass #2

Date: 6-1-89
Personnel: CSA/DDD

Time Start	1243		1243					
Time End	1246		1246					
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	A	S	A
1	1.7	-0.1	1.5	-0.6				
2	1.8	-0.2	1.7	0.1				
3	1.7	0	1.6	0.4				
4	1.9	-0.1	1.4	-0.2				
5	1.7	0	1.9	-0.8				
6	2.0	-0.2	1.6	-0.4				
7	1.9	-0.1	1.5	-1.4				
8	1.7	0	1.5	-0.4				
9	1.8	0.2	1.4	0.3				
10	1.7	-0.1	1.6	0.1				
Average	1.79	-0.06	1.57	-0.29				
Minimum	1.7	-0.2	1.4	-1.4				
Maximum	2.0	0.2	1.9	0.4				

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140"
Screen Diameter (in.) 168"
Screen Exposed (in.) 36"
Screen # By Pass #3 Screen Submerged (in.) 132"

Date: 6/1/89
Personnel: CSA/DDD

934.9' Forebay Elevation

Time Start	1124	1124		
Time End	1128	1128		

Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	A	S	A
1	1.6	-0.2	1.6	0				
2	1.6	-0.1	1.5	-1.0				
3	1.6	-0.1	1.2	-1.1				
4	1.7	0	1.6	0.4				
5	1.7	0	1.3	-0.7				
6	1.6	-0.2	1.7	0.3				
7	1.8	-0.1	1.5	-0.4				
8	1.8	-0.1	1.5	0.8				
9	1.8	-0.1	1.1	-1.4				
10	1.6	-0.1	1.4	-0.2				
Average	1.68	-0.1	1.44	-0.33				
Minimum	1.6	-0.2	1.1	-1.4				
Maximum	1.8	0	1.7	0.8				

Notes: 0.2 Z = Unit 818 0.8 Z = Unit 10 &o
+X = sweep
+y = Approach.

Used for all 0.2 & 0.8 Z measurements, including drum screens. CSA

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140 . Date: 6 /5/89 6/6/89
Screen Diameter (in.) 168 Personnel: - Hanj, Abor
Screen Exposed (in.) 36
Screen # 1 Screen Submerged (in.) 132

6/6/89

Time Start	1014	
Time End	1017	
Depth	0.2	
Vector	S	A
1	1.5	0.4
2	1.1	0.2
3	1.5	0.4
4	1.4	0.5
5	1.6	0.6
6	1.1	0.2
7	1.1	0.2
8	1.2	0.6
9	1.0	0.4
10	1.4	0.0
Average	1.29	0.35
Minimum	1.0	0.0
Maximum	1.6	0.6

Time Start	1014	
Time End	1017	
Depth	0.8	
Vector	S	A
1	0.0	-1.7
2	0.6	-1.4
3	0.3	1.9
4	0.5	0.4
5	2.4	2.1
6	2.2	1.6
7	2.0	-0.8
8	1.2	1.5
9	0.5	0.8
10	0.6	-0.6
Average	1.03	0.38
Minimum	0.0	-1.7
Maximum	2.4	2.1

6/5/89

Time Start	1752	
Time End	1755	
Depth	0.8a	
Vector	S	-A
1	0.9	-0.5
2	1.6	-0.8
3	1.0	-0.4
4	1.5	-0.8
5	1.7	-0.8
6	1.3	-0.6
7	0.6	-0.5
8	1.7	-0.8
9	1.0	-0.7
10	1.7	-0.4
Average	1.30	0.63
Minimum	0.6	0.4
Maximum	1.7	0.8

Time Start	1752	
Time End	1755	
Depth	0.8	
Vector	S	-A
1	1.2	-0.2
2	1.1	-0.6
3	0.2	-0.8
4	1.4	-1.2
5	0.7	-1.0
6	1.4	-0.9
7	0.7	-0.4
8	0.4	-0.7
9	0.7	-0.6
10	1.1	-0.8
Average	0.99	0.72
Minimum	0.4	0.2
Maximum	1.4	1.2

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140 Date: 6/5/89 6/6/89
Screen Diameter (in.) 168 Personnel: Hanf Abor
Screen Exposed (in.) 36
Screen # 2 Screen Submerged (in.) 132

	6/6/89		6/6/89		6/5/89		6/5/89	
Time Start	1007		1007		1742		1742	
Time End	1010		1010		1745		1745	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	A	S	A
1	1.6	0.3	1.4	0.1	1.8	-0.6	1.5	-0.4
2	1.8	0.3	1.4	0.0	1.6	-0.5	1.5	-0.4
3	1.6	0.3	2.0	1.0	1.7	-0.5	1.6	-0.4
4	1.6	0.3	1.3	-0.1	2.1	-0.5	1.7	-0.6
5	1.6	0.4	1.6	0.5	1.9	-0.6	1.7	-0.7
6	1.4	0.4	1.5	0.5	2.0	-0.6	1.4	-0.5
7	1.4	0.3	1.4	0.3	1.9	-0.6	1.4	-0.4
8	1.5	0.3	1.6	0.6	2.0	-0.6	1.5	-0.3
9	1.7	0.4	1.6	0.3	1.8	-0.5	1.4	-0.5
10	1.8	0.3	1.6	0.4	1.8	-0.6	1.6	-0.5
Average	1.60	0.33	1.54	0.36	1.86	0.56	1.53	0.47
Minimum	1.4	0.3	1.3	-0.1	1.6	0.5	1.4	0.3
Maximum	1.8	0.4	2.0	0.6	2.1	0.6	1.7	0.7

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 3 Screen Submerged (in.) 132

Date: 6/5/89 6/6/89
Personnel: Hart Fox

	6/6/89		6/5/89	
Time Start	I 0959	0959	1733	1733
Time End	1002	1002	1737	1737

Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	−A	S	−A
1	2.0	0.3	1.8	0.2	0.3	−0.5	2.4	−0.9
2	1.8	0.2	1.8	0.5	1.9	−0.4	1.6	−0.4
3	1.8	0.3	1.8	0.3	2.4	−1.1	2.6	−2.0
4	3.6	2.5	1.8	0.2	0.5	−0.4	1.8	−2.0
5	1.9	0.2	1.7	0.3	−3.2	0.4	0.9	−0.6
6	1.7	0.2	1.8	0.5	2.4	−0.4	0.8	0.1
7	1.8	0.0	0.7	−0.2	2.2	−0.5	0.7	−0.2
8	2.9	1.9	1.0	−0.4	−0.8	−0.2	1.8	−0.7
9	1.9	1.0	1.8	0.4	1.4	−0.2	2.5	−0.9
10	3.2	2.5	0.6	−0.6	0.3	−0.2	1.9	−0.8
Average	2.2 6	0.41	1.76	0.12	0.64	0.35	1.70	0.84
Minimum	1.8	0.0	0.6	−0.6	−3.2	0.2	1.6	−0.1
Maximum	3.6	2.5	1.8	0.5	2.4	1.1	2.6	2.0

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 4
Screen Submerged (in.) 132

Date: 6/5/89 6/6/89
Personnel: Hong, Abor

	6/6/89		6/6/89		6/5/89		6/5/89	
Time Start	0952		0952		1722		1722	
Time End	0955		0955		1725		1725	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	A	S	A
1	1.7	0.3	1.5	0.2	1.9	-0.6	1.6	-0.4
2	2.0	0.3	1.6	0.3	1.9	-0.6	1.5	-0.5
3	1.9	0.3	1.6	0.1	2.0	-0.8	1.8	-0.4
4	2.1	0.3	1.7	0.3	2.1	-0.7	1.7	-0.5
5	1.9	0.3	1.7	0.4	2.1	-0.6	1.7	-0.6
6	2.0	0.3	1.6	0.3	2.0	-0.7	1.6	~~-0.4~~ -1.0
7	2.0	0.3	1.6	0.3	2.0	-0.8	1.6	-0.7
8	2.0	0.3	1.7	0.2	1.9	-0.6	1.5	-0.6
9	1.9	0.3	1.5	0.4	1.8	-0.6	1.6	-0.7
10	1.8	0.3	1.7	0.2	2.0	-0.7	1.6	-0.6
Average	1.93	0.30	1.62	0.27	1.97	0.67	1.62	0.62
Minimum	.7	0.3	1.5	0.1	1.8	0.6	1.5	0.4
Maximum	2.1	0.3	1.7	0.4	2.1	0.8	1.7	1.0

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 5 Screen Submerged (in.) 32

Date: 6/5/89 6/6/89
Personnel: an A r

	6/6/89		6/6/89		6/5/89		6/5/89	
Time Start	0945		0945		1711		1711	
Time End	0948		0948		1714		1714	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	– A	S	– A
1	2.0	0.3	1.7	0.3	2.2	–0.6	1.8	–0.6
2	2.0	0.3	1.7	0.4	2.1	–0.8	1.7	–0.3
3	2.1	0.4	1.8	0.4	2.1	–0.7	1.9	–0.6
4	2.0	0.3	1.7	0.2	2.2	–0.6	1.8	–0.7
5	2.1	0.4	1.7	0.3	2.3	–0.6	1.9	–0.7
6	2.0	0.4	1.8	0.3	2.3	–0.6	1.9	–0.5
7	2.0	0.4	1.7	0.2	2.0	–0.7	1.8	–0.6
8	2.0	0.4	1.7	0.2	2.0	–0.6	1.7	–0.4
9	2.0	0.3	1.7	0.3	2.0	–0.6	1.7	–0.6
10	2.1	0.3	1.6	0.3	2.0	–0.8	1.6	–0.6
Average	2.03	0.	1.71	0.29	2.12	0.66	1.78	0.56
Minimum	2.0	0.3	1.6	0.2	2.0	0.6	1.6	0.3
Maximum	2.1	0.4	1.8	0.4	2.3	0.8	1.9	0.7

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 6 Screen Submerged (in.) 132

Date: 6/5/89 6/6/89
Personnel: Hant Ahor

	6/6/89				6/5/89			
Time Start	0939		0939		1703		1703	
Time End	0941		0941		1706		1706	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	−A	S	−A
1	1.6	0.2	0.9	0.3	1.0	−0.5	1.0	−0.6
2	1.3	0.2	0.7	0.2	0.8	−0.4	1.0	−0.4
3	1.4	0.2	1.1	0.4	1.1	−0.4	1.0	−0.6
4	1.2	0.1	0.8	0.2	0.9	−0.5	1.1	−0.5
5	1.1	0.1	0.9	0.3	1.0	−0.4	1.1	−0.6
6	1.4	0.2	0.9	0.4	1.0	−0.5	1.0	−0.5
7	1.4	0.1	0.9	0.5	0.8	−0.3	1.1	−0.6
8	1.4	0.1	1.1	0.3	1.0	−0.5	0.9	−0.6
9	1.5	0.1	0.9	0.3	0.8	−0.4	0.8	−0.7
10	1.4	0.3	0.9	0.2	1.0	−0.4	0.9	−0.6
Average	1.37	0.16	0.91	0.29	0.93	0.43	0.99	0.57
Minimum	1.1	0.1	0.7	0.2	0.8	0.3	0.8	0.4
Maximum	1.6	0.3	1.1	0.4	1.1	0.5	1.1	0.7

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 7 Screen Submerged (in.) 132

Date: 6/5/89 ; 6/6/89
Personnel: Harf, Abor

	6/6/89				6/5/89			
Time Start	0931		0931		1651		1651	
Time End	0934		0934		1654		1654	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	– A	S	– A
1	1.8	0.3	1.1	-0.3	1.9	-0.4	1.5	-0.9
2	1.8	0.3	1.6	0.8	1.6	-0.3	1.5	-0.6
3	1.9	0.3	1.2	-0.2	1.6	-0.1	1.3	-0.7
4	1.8	0.4	1.7	0.5	1.5	-0.2	1.4	-0.3
5	2.0	0.4	1.8	0.7	1.5	-0.4	1.4	-0.5
6	1.9	0.4	1.4	0.2	2.3	-0.4	1.5	-0.7
7	2.0	0.4	1.3	0.0	2.0	-0.1	1.3	-0.3
8	1.9	0.2	1.3	0.1	2.1	-0.4	1.5	-0.6
9	1.9	0.3	1.3	0.4	1.7	-0.3	1.4	-0.5
10	1.8	0.3	1.6	0.6	1.7	-0.2	1.5	-0.7
Average	1.88	0.33	1.43	0.28	1.79	0.28	1.43	0.58
Minimum	1.8	0.2	1.1	-0.3	1.5	0.1	1.3	0.3
Maximum	2.0	0.4	1.8	0.8	2.3	0.4	1.5	0.9

Notes: ALL READINGS SLIGHTLY UNSTABLE, NEEDLE OSCILLATING (6/5/89)

Readings slightly unstable on 6/6/89 also CKB.

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 8 Screen Submerged (in.) 132

Date: 6/5/89 6/6/89
Personnel: Hanf Ahern

	6/6/89				6/5/89			
Time Start	0724		0924		1643		1643	
Time End	0927		0927		1646		1646	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	-A	S	-A
1	1.6	-0.2	1.6	0.3	1.8	-0.6	1.3	-0.6
2	1.8	0.3	1.4	0.2	1.9	-0.8	1.5	-0.9
3	1.8	0.3	1.4	0.2	1.8	-0.6	1.4	-0.9
4	1.8	0.4	1.5	0.3	1.9	-0.5	1.4	-0.5
5	2.0	0.3	1.5	0.2	2.0	-0.7	1.5	-0.6
6	1.9	0.3	1.5	0.2	1.9	-0.7	1.5	-0.6
7	1.9	0.3	1.5	0.3	1.6	-0.6	1.4	-0.4
8	1.9	0.3	1.7	0.4	1.9	-0.6	1.3	-0.7
9	2.0	0.3	1.7	0.3	2.2	-0.6	1.6	-0.7
10	2.1	0.3	1.5	0.4	2.0	-0.6	1.5	-0.4
Average	1.88	0.26	1.53	0.28	1.90	0.63	1.44	0.61
Minimum	1.6	-0.2	1.4	0.2	1.8	0.5	1.3	0.4
Maximum	2.1	0.4	1.6	0.4	2.2	0.8	1.6	0.9

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen #c[illegible]een Submerged (in.) 132

Date: 6/5/89 6/6/89
Personnel: Hant, Abor

6/6/89 6/5/89

Time Start	0904		0904		1636		1636	
Time End	0907		0907		1639		1639	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	-A	S	-A
1	1.9	0.3	1.6	0.4	2.0	-0.8	1.5	-0.7
2	1.8	0.3	1.4	0.3	2.0	-0.7	1.6	-0.5
3	1.9	0.3	1.4	0.5	2.0	-0.7	1.6	-0.6
4	1.9	0.4	1.5	0.4	1.9	-0.9	1.6	-0.6
5	1.9	0.4	1.5	0.4	1.8	-0.7	1.6	-0.8
6	1.8	0.4	1.5	0.3	2.1	-0.7	1.4	-0.7
7	1.8	0.3	1.5	0.3	2.0	-0.8	1.5	-0.7
8	1.8	0.3	1.6	0.4	1.9	-0.8	1.6	-0.9
9	1.9	0.4	1.6	0.3	1.8	-0.7	1.4	-0.5
10	1.9	0.3	1.6	0.3	1.9	-0.6	1.5	-0.6
Average	1.86	0.34	1.52	0.36	1.94	0.74	1.53	0.64
Minimum	1.8	0.3	1.4	0.3	1.8	0.6	1.4	0.5
Maximum	.9	0.4	1.6	0.5	2.1	0.9	1.6	0.8

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140 · · Date: 6/5/89 6/6/89
Screen Diameter (in.) 168 Personnel: Hort Abor
Screen Exposed (in.) 3 36
Screen # 10 Screen Submerged (in.) 132

	6/6/89		6/6/89		6/5/89		6/5/89	
Time Start	0857		0857		1626		1626	
Time End	0900		0900		1630		1630	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	−A	S	−A
1	1.9	0.3	1.3	0.1	1.4	−0.4	1.4	−0.5
2	1.8	0.3	1.4	0.4	1.8	−0.5	1.5	−0.6
3	2.0	0.3	1.4	0.2	1.8	−0.5	1.5	−0.5
4	1.9	0.3	1.4	0.3	1.8	−0.2	1.7	−0.6
5	1.9	0.3	1.5	0.4	0.6	−0.8	1.4	−0.4
6	1.9	0.3	1.5	0.3	2.1	−0.6	1.6	± 0.0
7	1.9	0.3	1.6	0.5	1.9	−0.4	1.7	−0.6
8	1.9	0.3	1.5	0.3	1.7	−0.4	1.5	−0.4
9	2.0	0.3	1.3	0.2	1.8	−0.3	1.4	−0.5
10	1.9	0.3	1.6	0.3	1.6	−0.2	1.5	−0.4
Average	1.91	0.3	1.45	0.30	1.65	0.43	1.52	0.45
Minimum	1.8	0.3	1.3	0.1	0.6	0.2	1.4	0.0
Maximum	2.0	0.3	1.6	0.5	2.1	0.8	1.7	0.6

Notes: HOT ! ! !

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140 — Date: 6/5/89 6/3/89
Screen Diameter (in.) 168 — Personnel: Hart Abor
Screen Exposed (in.) 36
Screen # 11 — Screen Submerged (in.) 132

	6/6/89		6/5/89	
Time Start	0849	0849	1618	1618
Time End	0852	0852	1621	1621

Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	A	S	A
1	1.2	0.0	1.0	0.0	1.3	−0.4	1.0	−0.4
2	1.3	0.1	1.2	0.1	1.2	−0.3	0.9	−0.4
3	1.3	0.1	1.1	0.0	1.2	−0.3	1.0	−0.4
4	1.3	0.1	1.0	0.0	1.2	−0.3	0.9	−0.3
5	1.4	0.0	0.8	0.0	1.2	−0.3	1.0	−0.3
6	1.5	0.1	1.0	0.0	1.2	−0.3	0.9	−0.4
7	1.5	0.1	1.1	0.0	1.1	−0.2	0.9	−0.4
8	1.4	0.1	1.1	0.0	1.1	−0.3	0.8	−0.3
9	1.2	0.0	1.1	0.0	1.3	−0.3	1.0	−0.3
10	1.2	0.0	1.0	0.0	1.3	−0.3	1.0	−0.4
Average	1.33	0.06	1.04	0.01	1.21	0.30	0.94	0.36
Minimum	1.2	0.0	0.8	0.0	1.1	0.2	0.8	0.3
Maximum	1.5	0.1	1.2	0.1	1.3	0.4	1.0	0.4

Notes:

Wapato Screening Facility Flow Measurements

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Total Forebay Depth (in.) 140 Date: 6/5/89 6/6/89
Screen Diameter (in.) 168 Personnel: Hanf, Abex
Screen Exposed (in.) 36
Screen # 12 Screen Submerged (in.) 132

	6/6/89				6/5/89			
Time Start	0842		0842		1609		1609	
Time End	0845		0845		1613		1613	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	—A	S	—A
1	[illegible]	[illegible]	1.3	0.2	1.5	-0.4	1.0	-0.5
2	1.6	0.3	1.2	0.3	1.7	-0.6	1.2	-0.5
3	1.6	0.2	1.3	0.2	1.7	-0.5	1.1	-0.5
4	1.6	0.3	1.2	0.3	1.5	-0.6	1.2	-0.4
5	1.8	0.3	1.3	0.2	1.7	-0.6	1.2	-0.7
6	1.7	0.3	1.2	0.2	1.4	-0.6	1.1	-0.4
7	1.6	0.3	1.3	0.3	1.7	-0.7	1.2	-0.5
8	1.6	0.3	1.2	0.2	1.6	-0.6	1.0	-0.6
9	1.6	0.3	1.3	0.2	1.5	-0.6	1.3	-0.6
10	1.6	0.3	1.3	0.2	1.5	-0.5	1.2	-0.4

Average	1.64	0.29	1.26	0.23	1.58	0.57	1.15	0.51
Minimum	1.6	0.2	1.2	0.2	1.4	0.4	1.0	0.4
Maximum	1.8	0.3	1.3	0.3	1.7	0.7	1.3	0.7

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 16 8
Screen Exposed (in.) 3 6
Screen # 13 Screen Submerged (in.) 13 2

Date: 6/5/89 6/6/89
Personnel: ACPR HANF

	6/6/89		6/6/89		6/5/89		6/5/89	
Time Start	0835		0835		1602		1602	
Time End	0838		0838		1606		1606	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	− A	S	− A
1	1.5	0.2	1.0	0.3	1.6	−0.7	1.1	−0.5
2	1.5	0.4	1.2	0.4	1.5	−0.5	1.0	−0.5
3	1.7	0.4	1.1	0.2	1.3	−0.6	1.0	−0.6
4	1.6	0.3	1.2	0.4	1.3	−0.6	0.9	−0.6
5	1.5	0.3	1.0	0.4	1.2	−0.5	1.0	−0.5
6	1.4	0.3	1.0	0.5	1.7	−0.6	1.1	−0.8
7	1.5	0.3	1.1	0.4	1.6	−0.7	1.2	−0.6
8	1.5	0.3	1.1	0.4	1.6	−0.8	1.2	−0.7
9	1.5	0.3	1.1	0.4	1.2	−0.5	1.1	−0.6
10	1.5	0.4	1.0	0.3	1.3	−0.6	1.0	−0.7
Average	1.52	0.32	1.08	0.37	1.39	0.61	1.06	0.61
Minimum	1.4	0.2	1.0	0.3	1.2	0.5	0.9	0.5
Maximum	1.7	0.4	1.2	0.5	1.6	0.8	1.2	0.8

Notes:

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 3 6
Screen # 14 Screen Submerged (in.) 132

Date: 6/5/89 6/6/89
Personnel: Hanf Abor

6/6/89 — 6/5/89

Time Start	0827	0827	1554	1554
Time End	0830	0830	1557	1557

Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	-A	S	-A
1	1.5	0.3	1.0	0.4	1.2	-0.5	0.9	-0.6
2	1.4	0.3	0.8	0.2	1.3	-0.6	0.9	-0.5
3	1.5	0.4	1.0	0.3	1.3	-0.6	0.9	-0.6
4	1.4	0.3	1.1	0.4	1.4	-0.6	1.1	-0.6
5	1.7	0.3	1.0	0.2	1.4	-0.6	1.1	-0.6
6	1.4	0.3	0.9	0.3	1.4	-0.5	1.0	-0.7
7	1.2	0.2	1.1	0.3	1.3	-0.6	0.9	-0.6
8	1.5	0.3	1.1	0.3	1.3	-0.6	1.0	-0.7
9	1.4	0.3	0.9	0.3	1.4	-0.6	0.9	-0.7
10	1.4	0.3	1.0	0.3	1.3	-0.6	1.0	-0.5
Average	1.44	0.31	0.99	0.30	1.33	0.58	0.97	0.61
Minimum	1.2	0.3	0.8	0.2	1.2	0.5	0.9	0.5
Maximum	1.7	0.4	1.1	0.4	1.4	0.6	1.1	0.7

Notes:

Wapato Screening Facility Flow Measurements

: Total Forebay Depth (in.) 140
Screen Diameter (in.) 168
Screen Exposed (in.) 36
Screen # 15 Screen Submerged (in.) 132

Date: 6/5 - 6/6/89
Personnel: CA/RWP

	6/6/89		6/6/89		6/5/89		6/5/89	
Time Start	0818		0818		1544		1544	
Time End	0822		0822		1547		1547	
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	-A	S	-A
1	1.4	0.5	1.0	0.4	1.1	-0.7	0.7	-0.7
2	1.0	0.5	1.0	0.5	1.2	-0.6	0.8	-0.6
		0.4	0.9	0.4	1.1	-0.7	0.7	-0.7
4	1.2	0.4	0.9	0.4	1.2	-0.6	0.8	-0.6
5	1.2	0.5	0.8	0.5	1.1	-0.7	0.8	-0.7
6	1.3	0.4	0.9	0.4	1.1	-0.7	0.7	-0.7
7	1.1	0.4	0.9	0.5	1.0	-0.7	0.7	-0.7
8	1.1	0.4	1.0	0.4	1.3	-0.7	0.7	-0.8
9	1.2	0.4	0.8	0.3	1.2	-0.8	0.7	-0.7
10	1.4	0 4	0.9	0.4	1.1	-0.7	0.8	-0.6
Average	1.20	0.43	0.91	0.42	1.14	0.69	0.74	0.68
Minimum	1.0	0.4	0.	0.3	1.0	0.6	0.7	0.6
Maximum	1.	0.5	1.0	0.5	1.3	0.8	0.8	0.8

Notes: 6/5/89 0.8a - Unit 1020 0.8 = Unit 824
+Y = Sweep +X = Sweep
-X = Approach -Y -- Approach
Same for all Screens. CSA

Last net pulled at 1515 hrs on 6/5/8 4

6/6/89 0.2. = Unit 1020 0.8 = unit 824
+X = Sweep +X = Sweep
+Y = Approach +Y = Approach
Same for all screens CSA

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140"
Screen Diameter (in.)
Screen Exposed (in.)
Screen # Bypass #1 Screen Submerged (in.)

Date: 6/6/90
Personnel: RJE CSA

Time Start	1038		1038					
Time End	1041		1041					
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	A	S	A
1	1.6	0.2	1.3	-0.6				
2	1.7	-0.2	1.2	-0.2				
3	1.7	-0.1	1.3	-0.6				
4	1.7	0.1	1.3	-0.5				
5	1.9	-0.3	1.4	-0.7				
6	1.7	-0.3	1.3	-0.6				
7	1.7	0.1	1.2	-0.5				
8	1.9	-0.2	1.3	-0.5				
9	1.8	0.4	1.3	-0.6				
10	1.9	-0.3	1.2	-0.3				
Average	1.76	-0.06	1.28	-0.51				
Minimum	1.6	-0.3	1.2	-0.7				
Maximum	1.9	0.4	1.4	-0.2				

Notes: Measurements taken with Base of vertical probe support rod at upstream stoplog slot in each bypass; Probes 18" upstream in center line of bypass slot.

Same location as measurements of 6/1/89 CSA.

Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140"
Screen Diameter (in.) X
Screen Exposed (in.) X
Screen #Bypass #2 Screen Submerged (in.) X

Date: 6 6 /89
Personnel: CSA RWL

	0.2		0.8		0.8a		0.8	
Time Start	1053		1053					
Time End	1056		1056					
Vector	S	A	S	A	S	A	S	A
1	2.0	0.0	1.3	-0.2				
2	2.1	0.1	1.2	-0.2				
3	2.0	-0.3	1.3	-0.3				
4	2.0	-0.1	1.1	-0.1				
5	2.1	0.1	1.2	-0.3				
6	1.9	-0.2	1.3	-0.4				
7	1.8	-0.4	1.3	-0.3				
8	1.9	±0.0	1.3	-0.5				
9	1.8	0.1	1.2	-0.2				
10	2.1	-0.2	1.3	-0.4				
Average	1.93	-0.09	1.25	-0.29				
Minimum	1.8	-0.4	1.1	-0.5				
Maximum	2.1	0.1	1.3	-0.1				

Notes:

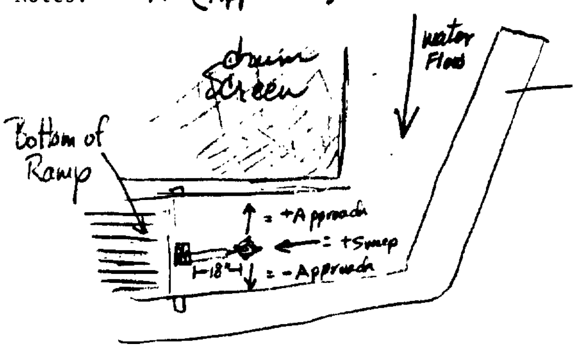
Wapato Screening Facility Flow Measurements

Total Forebay Depth (in.) 140"
Screen Diameter (in.) X
Screen Exposed (in.) X
Screen # Bypass #3 Screen Submerged (in.) X

Date: 6/6/89
Personnel: Cha/Ruth

Time Start	1105		1105					
Time End	1108		1108					
Depth	0.2		0.8		0.8a		0.8	
Vector	S	A	S	A	S	A	S	A
1	1.8	-0.2	1.3	-0.5				
2	1.6	-0.3	1.1	-0.4				
3	2.0	-0.3	1.3	0.0				
4	2.0	0.0	1.2	0.0				
5	1.8	-0.1	1.4	-0.5				
6	1.8	-0.1	1.3	-0.2				
7	1.6	0.0	1.2	-0.5				
8	1.7	-0.2	1.1	-0.3				
9	1.8	0.0	1.2	-0.2				
10	1.8	-0.2	1.0	-0.3				
Average	1.79	-0.14	1.21	-0.29				
Minimum	1.6	-0.3	1.0	-0.5				
Maximum	2.0	0.0	1.4	0.0				

Notes: +A (Approach) is movement towards the screen upstream (see diagram)



Measurements (probe location) at 18" upstream of stoplog slot where ramp starts.

APPENDIX C

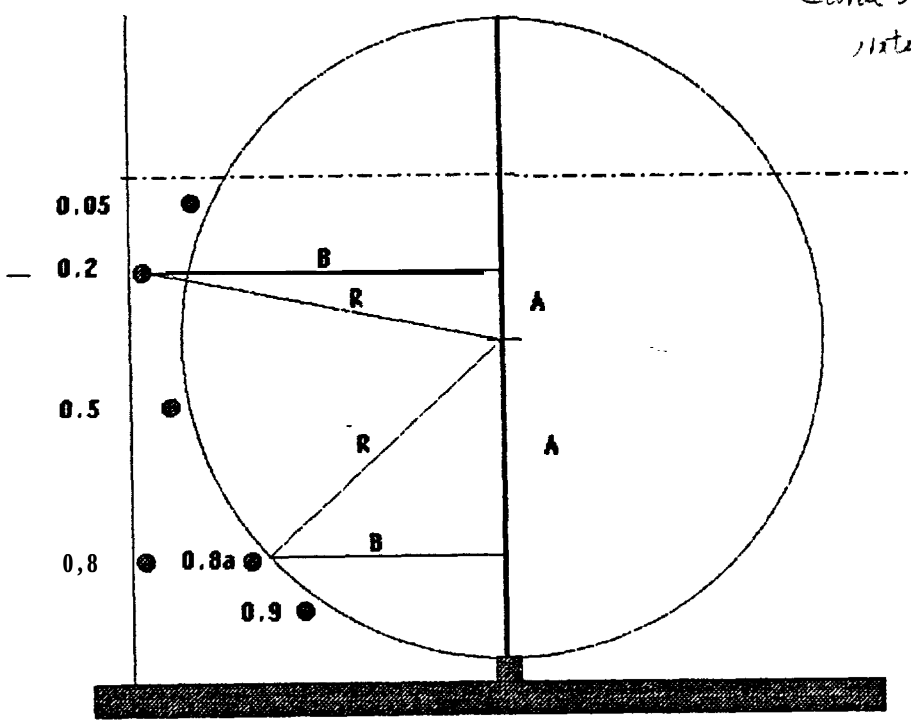
CHANDLER SCREENS RAW DATA SHEETS

APPENDIX C

CHANDLER SCREENS RAW DATA SHEETS

This appendix contains the raw data sheets for flow measurements taken at the Chandler Screens on July 26 through 28. 1989. Page C.2 shows the calculations made to position probes at the proper depths and the distance between the probe and the screen face at each depth. Raw data for measurements taken in front of the drum screens are presented on pages C.3 through 8.25. Raw data for measurements taken at the entrance to the fish bypass pipes are shown on pages C.26 through C.28. A map showing measurement locations in the separation chamber is found on page C.29, and raw data for measurements taken in the separation chamber are found on pages C.30 through C.34.

Chandler Screens
Canal Surface El 630.1
water depth = "



Drum Diameter (D): 162"
Radius (R): 81"
Exposed to Air (E): 54"
Submerged (Z): 108"   Measured depth = 112" ; 4" seal height

	Side A	Side B
0.2 Z : 21.6	A = R-(E+0.2 Z) 5.4	B = $(R^2-A^2)^{0.5}$ 80.82
0.8 Z: 86.4	A = R-(E+0.8 Z) 59.4	B = $(R^2-A^2)^{0.5}$ 55.07
0.8a Z: 85.4	A = R-(E+0.8a Z) 55.4	B = $(R^2-A^2)^{0.5}$ 07
0.9 Z: 97.2	A = R-(E+0.9 Z) 40.2	B = $(R^2-A^2)^{0.5}$ 4 . 41
0.05 Z: 5.4	A = R-(E+0.05 Z) 21.6	B = $(R^2-A^2)^{0.5}$ 78.07
0.5 Z: 54.0"	A = R-(E+0.5 Z) 27.0	B = $(R^2-A^2)^{0.5}$ 76.37

Distance From Vertical to Screen Face

0.2 Z: R-B=	0.18"
0.8 Z: R-B=	25.9"
0.8a Z: R-B=	25.9"
0.9 Z: R-B=	40.59
0.05 Z: R-B=	2.93
0.5 Z: R-B=	4.63

Chandler Fish Screening Facility Flow Measurements

, Screen # 1

Screen Diameter (in) 132
Exposed (in) 24
Submerged (in) 108

Forebay Elevation 630.1
Canal Flow 1100 cfs

Date [illegible]
Personnel [illegible]

Time Start	1357		1357									
Time End	1400		1400									
Unit	225	1020	824	818								

Location	U (C) L				U (C) L			
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	0.5	0	0.1	0.1	0.2	0.1	0.1	0.2
2	0.6	0.1	0.1	0.1	0.4	0.1	0	0.2
3	0.5	0.1	0.1	0.1	0.4	0.1	0	0.2
4	0.6	0	0	0.1	0.4	0.1	0	0.2
5	0.5	0	0	0.1		0.2	0	0.2
6	0.5	0	0.1	0.1	[illegible]	0.1	0.1	0.2
7	0.4	0	0.1	0.1	0.3	0.1	0	0.2
8	0.5	0	-0.1	0.1	0.3	0.1	0	0.2
9	0.4	0	0.1	0.1	0.3	0.1	0	0.2
10	0.3	0	0.1	0.1	0.3	0.1	0	0.2
Average	0.47	0.02	-0.06	0.10	0.33	0.11	-0.02	0.20
Minimum	0.3	0	-0.1	0.1	0.2	0.1	-0.1	0.2
Maximum	0.6	0.1	0.1	0.1	0.4	0.2	0	0.2

Location	U C L				U C L				U C L				U C L			
Depth	0.08a				0.9				.05				0.5			
Vector	S	A	V		S	A	V		S	A	V		S	A	V	
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
Average																
Minimum																
Maximum																

Notes:

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation [illegible] 3.[illegible]
Canal Flow 1100 cfs

Date [illegible]
Personnel [illegible]

Screen # 2

Screen Diameter (in) 162
Exposed (in) 54
Submerged (in) 108

Time Start	1350		1350									
Time End	1354		1354									
Unit	[illegible]	1020	924	818								

Location	U C L				U C L				U C L				U C L				U C L				U C L			
Depth	0.2				0.8				0.08a				0.9				05				0.5			
Vector	S	A	V	A	S	A	V	A	S	A	V		S	A	V		S	A	V		S	A	V	
1	0.4	-0.1	0	0.1	0.5	0.1	0	0.2																
2	0.6	0	0	0.1	0.5	0.1	0	0.1																
3	0.4	0	0	0.1	0.5	0.1	0	0.1																
4	0.7	0	0.1	0.1	0.6	0	0.1	0.1																
5	0.7	0	0.1	0.1	0.7	0	0	0.1																
6	0.5	0	0.1	0.1	0.6	0	0	0.1																
7	0.7	0	0.2	0.1	0.5	0	0	0.1																
8	0.6	0	0.2	0.1	0.6	0	0.1	0.1																
9	0.7	0	0.1	0.1	0.5	0.1	0	0.1																
10	0.7	0	0.1	0.1	0.5	0	0.1	0																

Average	0.60	0	[illegible]	0.10	[illegible]	0.04	0.05	[illegible]																
Minimum	0.4	-0.1	-0.2	0.1	0.5	0	-0.1	0.0																
Maximum	0.7	0	0	0.1	0.7	0.1	0	0.2																

Notes:

C.4

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation [illegible]

Canal Flow 1100 cfs

Date [illegible]

Personnel [illegible]

Screen # 3

Screen Diameler (in) 16[illegible]

Exposed (in) [illegible]

Submerged (in) [illegible]

Time Start	1343		1343			
Time End	1348		1348			
Unit	[illegible]	[illegible]	220	218		

Location	U (C) L				U (C) L			
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	0.7	0	0.1	0.1	0.6	0.1	0.1	0.1
2	0.7	0	0.1	0.1	0.6	0	0.1	0.1
3	0.7	0.1	0.2	0.	0.6	0.1	0	0.2
4	0.	0	0.2	0.1	0.6	0	0.1	0.1
5	0.6	0	0.1	0.1	0.6	0.1	0	0.2
6	0.4	0	0.1	0.1	0.6	0.1	0	0.2
7	0.9	0	0.3	0.1	0.7	0	0	0.1
8	0.8	[illegible]	0	0.1	0.6	0	0	0.1
9	0.8	0.1	0.1	0.2	0.7	0.1	0.1	0.1
10	0.8	0.1	0.1	0.1	0.6	0	0	0.1
Average	.11	0.03	-0.13	0.11	0.62	0.05	0.01	.14
Minimum	0.4	0	-0.3	0.1	0.6	0	-0.1	0.1
Maximum	0.9	0.1	-0.1	0.2	0.7	0.1	0	0.2

U C L				U C L				U C L				U C L			
0.08a				0.9				.05				0.5			
S	A	V		S	A	V		S	A	V		S	A	V	

Notes:

C.6

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 630.1
CanalFlow 1100 cfs

Date 7/26/89
Personnel [illegible]

Screen # 4

Screen Diameter (in) 162
Exposed (in) 54
Submerged (in) 108

Time Start	1336			
Time End	1340			
Unit	[illegible]	1020		
Location	U C L			
Depth	0.2			
Vector	S	A	-V	A
1	0.7	0.1	0	0.2
2	0.9	0.1	0.1	0.2
3	0.9	0.1	0.1	0.2
4	0.9	0.1	0.1	0.2
5	0.8	0.1	0	0.2
6	0.9	0.1	0.1	0.2
7	0.8	0.1	0.1	0.2
8	0.9	0.1	0.1	0.1
9	0.9	0.1	0.1	0.2
10	0.9	0.1	0	0.1
Average	[illegible]	[illegible]	[illegible]	[illegible]
Minimum	0.7	0.1	-0.1	0.1
Maximum	0.9	0.1	0	0.2

Time Start	1336			
Time End	1340			
Unit	824	818		
Location	U C L			
Depth	0.8			
Vector	S	A	-V	A
1	0.7	0.1	0	0.2
2	0.7	0.2	0	0.2
3	0.7	0.1	0.1	0.2
4	0.8	0.1	0	0.2
5	0.8	0.1	0	0.2
6	0.8	0.1	0	0.1
7	0.7	0.1	0	0.2
8	0.7	0.1	0	0.2
9	0.7	0.1	0	0.2
10	0.6	0.1	0	0.2
Average	0.72	.11	0.01	0.17
Minimum	0.6	0.1	-0.1	0.1
Maximum	0.8	0.2	0	0.2

Location	U C L			
Depth	0.08a			
Vector	S	A	V	

Location	U C L			
Depth	0.9			
Vector	S	A	V	

Location	U C L			
Depth	.05			
Vector	S	A	V	

Location	U C L			
Depth	0.5			
Vector	S	A	V	

Notes:

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 5.30.1
Canal Flow 1100 cfs

Date 7/26/9?
Personnel [illegible]

Screen Diameter (in) 162
Exposed (in) 50
Submerged (in) 138

Screen # 5

Time Start	1329		1329									
Time End	1333		1333									
Unit	[illegible]	1320	821	818								

Location	U C L				U C				U C L				U C L				U C L				U C L			
Depth	0.2				0.8				0.08a				0.9				.05				0.5			
Vector	S	A	~~V~~	~~A~~	S	A	~~V~~	~~A~~	S	A	V		S	A	V		S	A	V		S	A	V	
1	0.9	0.1	0.2	0.2	0.7	0.1	0	0.2																
2	1.1	0.1	0.2	0.2	0.8	0.1	0.1	0.2																
3	1.0	0.1	0.1	0.2	0.8	0.2	0	0.2																
4	0.8	0.1	0.1	0.2	0.7	0.1	0	0.2																
5	0.9	0.1	0.1	0.2	0.8	0.1	0	0.1																
6	0.8	0.1	0	0.2	0.7	0.1	0.1	0.2																
7	0.8	0.1	0.1	0.2	0.8	0.2	0	0.3																
8	0.8	0.1	0.2	0.2	0.8	0.1	0.1	0.2																
9	0.8	0.1	0.1	0.2	0.7	0.1	0	0.2																
10	0.8	0.1	0.1	0.2	0.7	0.1	0	0.2																

Average	0.87	0.10	-0.12	0.16	0.75	0.12	[illegible]	0.20																
Minimum	0.8	0.1	-0.2	0.2	0.7	0.1	-0.1	0.1																
Maximum	1.1	0.1	-0.11	0.2	0.8	0.2	0	0.3																

Notes:

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation [illegible]

Canal Flow 1100 cfs

Date 7/26/85

Personnel [illegible]

Screen Diameter (in) 162

Exposed (in) 54

Submerged (in) 108

Screen # 6

Time Start	1321				1321			
Time End	1325				1325			
Unit	823		1020		824		818	
Location	U C L				U C L			
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	0.9	0.1	0.1	0.2	0.8	0.1	0.1	0.2
2	0.9	0.1	0.1	0.2	0.8	0.1	0.1	0.3
3	[illegible]	0.1	0.2	0.2	0.8	0.1	0.1	0.2
4	1.0	0.1	0.1	0.2	0.8	0.1	0	0.2
5	0.9	0.1	0.1	0.2	0.8	0.1	0	0.2
6	0.9	0.1	0.1	0.2	0.7	0.1	0.1	0.2
7	1.0	0.1	0.1	0.2	0.8	0.1	0.1	0.2
8	0.9	0.1	0.1	0.2	0.8	0.1	0	0.2
9	0.9	0.1	0.1	0.2	0.7	0.1	0	0.2
10	0.9	0.1	0.1	0.2	0.8	0.1	0	0.2
Average	0.90	0.10	-0.11	0.25	0.78	0.10	-0.05	0.21
Minimum	0.8	0.1	-0.2	0.2	0.7	0.1	-0.1	0.2
Maximum	1.0	0.1	-0.1	0.2	0.8	0.1	0	0.3

U C L				U C L				U C L				U C L			
0.08a				0.9				.05				0.5			
S	A	V		S	A	V		S	A	V		S	A	V	

Notes:

C.8

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 7/26 630.1 - 7/27 630.0

Canal Flow 1100 - 1037 cfs

Date 7/26-27/8[illegible]

Personnel [illegible]

Screen # 7

Screen Diameter (in) 16 2

Exposed (in) 54

Submerged (in) 10 8

Time Start	1314 7/26	1314 7/26	1217 7/27	1217 7/27	1020 7/27	1020 7/27
Time End	1318	1318	1221	1221	1023	1023
Unit						

Location	U C L				U C L				U C L			
Depth	0.2				0.8				0.08a			
Vector	S	A	-V	A	S	A	-V	A	S	A	-V	A
1	1.1	0.2	0.1	0.3	0.7	0.2	0	0.3	1.7	0.6	0.1	0.5
2	1.0	0.1	0.1	0.3	0.8	0.1	0	0.3	1.8	0.8	0.1	0.5
3	1.0	0.2	0	0.2	0.8	0.1	0	0.3	1.7	[illegible]	0.1	0.6
4	1.1	0.2	0	0.3	0.7	0.2	0	0.2	1.9	0.8	[illegible]	0.6
5	0.9	0.1	0.1	0.3	0.7	0.1	0	0.2	1.8	0.6	0.1	0.5
6	0.9	0.2	0.1	0.3	0.6	0.2	0	0.3	1.7	0.7	0.2	0.6
7	0.9	0.2	0.1	0.3	0.8	0.2	0.1	0.3	2.0	0.8	[illegible]	0.5
8	0.9	0.2	0.1	0.3	0.8	0.2	0	0.3	1.8	0.7	0.1	0.6
9	1.0	0.2	0.1	0.3	0.7	0.2	0	0.3	1.9	0.7	0.1	0.7
10	0.9	0.2	0.2	0.3	0.7	0.1	0	0.2	2.0	0.7	0.1	0.5
Average	0.97	0.18	-0.09	0.29	73	0.16	-0.01	0.27	0.58	0.70	-0.02	0.55
Minimum												
Maximum												

Location	U C L				U C L				U C L			
Depth	0.9				.05				0.5			
Vector	S	A	-V	A	S	A	-V	A	S	A	-V	A
1	0.4	0.3	-0.1	[illegible]	1.0	0.1	0.1	0.2	0.9	0.2	0.1	0.3
2	0.6	0.2	-0.1	0.3	0.9	0.2	0.1	0.3	0.8	0.2	0.1	0.2
3	0.5	0.3	-0.1	0.4	0.9	0.2	0.1	0.3	0.7	0.1	0.1	[illegible]
4	0.5	0.2	-0.2	0.3	0.8	0.1	0.2	0.3	0.7	0.2	0	0.2
5	0.6	0.2	-0.1	0.4	0.9	0.1	0.1	0.2	0.9	0.2	0	0.2
6	0.6	0.3	-0.1	0.3	1.0	0.1	0	0.2	0.9	0.1	0.1	0.3
7	0.6	0.3	-0.2	0.3	0.9	[illegible]	0	0.2	0.9	0.2	0.1	0.3
8	0.7	0.3	-0.1	0.3	0.9	0.1	0.2	0.3	0.9	0.2	0.1	0.3
9	0.6	0.4	-0.2	0.4	1.0	[illegible]	0	0.2	0.9	0.1	0.1	0.3
10	0.7	0.2	-0.1	0.4	0.9	0.1	0.1	0.2	0.7	0.2	0.1	0.3
Average		0.13		0.35	0.92	0.12	-0.09	0.24	0.88	0.17	-0.08	0.27
Minimum												
Maximum												

Notes:

C.9

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 7/26 630.1 - 7/27 630.0

Canal Flow 1100 - 1037 cfs

Date 7/25-27/89

Personnel [illegible]

Screen # 8

Screen Diameter (in) 162

Exposed (in) 54

Submerged (in) 108

Time Start	1251 7/26	1251 7/26	1210 7/27	1210 7/27	[illegible] 7/27	[illegible] 7/27
Time End	1255	1255	1214	1214	1015	1016
Unit						

Location	U C L				U C L			
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	0.9	0.2	0.2	0.3	0.7	0.1	0.1	0.3
2	0.9	0.2	0.1	0.3	0.6	0.1	0	0.3
3	0.9	0.2	0.1	0.3	0.6	0.1	0	0.2
4	0.9	0.2	0.1	0.3	0.7	0.1	0	0.2
5	0.9	0.2	0.1	0.3	0.8	0.2	0	0.3
6	1.0	0.3	0.2	0.3	0.7	0.1	0	0.2
7	1.0	0.2	0.1	0.3	0.6	0.2	0.1	0.3
8	1.0	0.2	0	0.3	0.7	0.1	0	0.3
9	0.8	0.2	0.2	0.3	0.7	0.1	0	0.3
10	1.0	0.2	0.1	0.3	0.7	0.2	0	0.3
Average	0.92	0.21	-0.12	0.30	0.68	0.13	-0.02	0.28
Minimum								
Maximum								

Location	U C L				U C L			
Depth	0.08a				0.9			
Vector	S	A	-V	A	S	A	-V	A
1	1.7	0.7	0.3	0.8	[illegible]	0.2	-0.1	[illegible]
2	1.7	0.8	0.3	0.7	0.3	0.2	-0.1	[illegible]
3	[illegible]	0.7	0.4	0.9	0.4	0.3	-0.1	0.4
4	1.8	0.6	0.3	0.7	[illegible]	0.2	-0.1	0.3
5	1.0	0.7	0.3	0.7	0.5	0.3	-0.1	[illegible]
6	[illegible]	0.7	[illegible]	0.8	0.4	0.3	-0.1	0.4
7	1.9	0.7	0.3	0.7	0.5	0.4	-0.1	0.4
8	1.8	0.7	0.3	0.8	[illegible]	0.3	-0.1	0.4
9	1.7	0.8	0.2	0.8	0.5	0.3	-0.1	0.4
10	1.8	0.6	0.2	0.7	0.4	0.3	-0.1	0.3
Average	0.94	0.75	0.0.16	0.76	0.4[illegible]	0.1728	0.10	0.29
Minimum								
Maximum								

Location	U C L				U C L			
Depth	.05				0.5			
Vector	S	A	-V	A	S	A	-V	A
1	0.9	[illegible]	[illegible]	[illegible]	0.7	0.2	0	0.3
2	1.0	0.2	0.2	0.3	[illegible]	0.2	0	[illegible]
3	0.9	0.1	0.3	0.3	[illegible]	[illegible]	0.1	0.3
4	1.1	0.4	0.2	[illegible]	[illegible]	[illegible]	[illegible]	0.3
5	[illegible]	0.1	0.2	0.3	[illegible]	0.2	[illegible]	0.3
6	1.0	0.1	0.1	0.3	[illegible]	[illegible]	[illegible]	0.3
7	1.0	0.2	0	0.3	[illegible]	0.2	[illegible]	0.3
8	0.8	0.1	0.2	0.3	0.7	0.1	0.1	0.2
9	0.8	0.2	0.2	0.3	0.8	0.1	0	0.2
10	1.0	0.1	0	0.2	0.8	0.2	0.1	0.3
Average		0.77			0.18	-0.07		0.28
Minimum								
Maximum								

Notes:

C.10

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 7/26 630.1 – 7/27 630.0 | Date 7-26-27-89
Canal Flow 1100-1037cfs | Personnel [illegible]

Screen # 9 | Screen Diameter (in) 1.2 | Exposed (in) .54 | Submerged (in) .08

	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6
Time Start	1242 7/26	1242 7/26	1304 7/27	—	1005 7/27	1005 7/27
Time End	1246	1246	1307		1007	1009
Unit			1			
Location	U G L	U C L	U C L	U C L	U C L	U C L
Depth	0.2	0.8	0.08a	0.9	.05	0.5

Vector	S	A	-V	A	S	A	-V	A	S	A	-V	A
1	1.0	0.2	0.1	0.8	0.8	0.2	0	0.4	1.7	0.6	0.4	0.8
2	1.1	0.2	0.1	0.3	0.8	0.2	-0.1	0.4	1.7	0.6	0.4	0.7
3	1.1	0.2	0.2	0.3	0.8	0.3	-0.1	0.4	1.7	0.7	0.4	0.9
4	1.1	0.2	0.1	0.3	0.7	0.2	0	0.4	1.8	0.6	0.4	0.8
5	1.1	0.2	0.1	0.4	0.8	0.3	-0.1	0.4	1.7	0.6	0.4	0.9
6	1.1	0.2	0.1	0.3	0.8	0.2	-0.1	0.4	1.8	0.7	0.4	0.8
7	1.1	0.2	0.1	0.4	0.8	0.2	0	0.4	1.7	0.5	0.3	0.7
8	1.2	0.2	0.1	0.4	0.8	0.2	0	0.4	1.6	0.5	0.3	0.7
9	1.1	0.2	0.1	0.4	0.7	0.2	-0.1	0.3	1.5	0.6	0.4	0.8
10	1.1	0.2	0.1	0.4	0.7	0.2	0	0.4	1.7	0.4	0.4	0.8
Average	1.10	0.24	-0.11	0.35	0.77	0.22	-0.05	0.39	1.69	0.58	-0.38	0.79
Minimum												
Maximum												

Vector	S	A	V		S	A	-V	A	S	A	-V	A
1					1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2					1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3					1.2	[illegible]	[illegible]	[illegible]	1.3	[illegible]	[illegible]	[illegible]
4					1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6					1.1	[illegible]	[illegible]	[illegible]	1.3	[illegible]	[illegible]	[illegible]
7					1.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8					1.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9					1.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Average					1.14	0.17	-0.09	0.3	1.02	0.20	-0.14	0.37
Minimum												
Maximum												

Notes: Too much silt to do #9, 0.9z (probes hung up/buried in mud). CAA 7/27/89

C.11

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 630.1

Canal Flow 1100 cfs

Dale 7/26/79

Personnel [illegible]

Screen # 10

Screen Diameter (in) 162

Exposed (in) 54

Submerged (in) 108

Time Start	1234		1234									
Time End	1234		1238									
Unit	723	[illegible]	[illegible]	[illegible]								

Location	U C L				U C L				U c L				U C L				U C L				U C L			
Depth	0.2				0.8				0.08a				0.9				.05				0.5			
Vector	S	A	-V	A	S	A	-V	A	S	A	V		S	A	V		S	A	V		S	A	V	
1	1.2	0.2	0.1	0.3	1.1	0.2	0.1	0.4																
2	1.1	0.1	0.1	0.3	1.1	0.2	0.1	0.3																
3	1.2	a	0.2	0.3	1.0	0.2	0.1	0.3																
4	1.2	0.1	0.1	0.3	0.9	0.2	0.1	0.3																
5	1.2	0.1	0.1	0.3	1.0	0.2	0.1	0.4																
6	1.1	0.2	0.1	0.3	1.1	0.2	0.1	0.4																
7	1.1	0.2	0.2	0.3	1.1	0.2	0.1	0.4																
8	1.2	0.2	0.2	0.3	1.1	0.2	0.1	0.3																
9	1.2	0.1	0.1	0.3	1.1	0.2	0.1	0.3																
10	1.2	0.1	0.1	0.3	1.1	0.2	0.1	0.3																
Average	1.17	0.15	0.12	[illegible]	1.16	0.20	0.10	[illegible]																
Minimum																								
Maximum																								

Notes:

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 630.1

Canal Flow 1100 cfs

Date 7/26/89

Personnel CKL/PBT

Screen # I

Screen Diameter (in) 162

Exposed (in) 54

Submerged (in) 108

Time Start	1227		1227									
Time End	1231		1231									
Unit	[illegible]	[illegible]020	824	818								

Location	U C L				U C L				U C L			
Depth	0.2				0.8				0.08a			
Vector	S	A	-V	A	S	A	-V	A	S	A	V	
1	1.2	0.1	0.1	0.3	1.0	0.2	0	0.3				
2	1.2	0.2	0.1	0.3	1.0	0.2	0	0.3				
3	1.2	0.2	0.1	0.3	0.9	0.2	0	0.3				
4	1.3	0.2	0.1	0.3	1.0	0.2	0.1	0.3				
5	1.3	0.2	0.1	0.3	1.0	0.2	0.1	0.3				
6	1.2	0.2	0.1	0.3	1.0	0.2	0.1	0.3				
7	1.3	0.2	0.2	0.3	1.1	0.3	0	0.3				
8	1.2	0.2	0.2	0.3	1.1	0.2	0.1	0.3				
9	1.2	0.2	0.2	0.3	1.0	0.2	0.1	0.3				
10	1.2	0.2	0.1	0.3	0.9	0.2	0.1	0.3				
Minimum Average	1.23	0.1	-0.2	0.30	1.0	0.21	-0.06	0.30				
					0.9	0.2	-0.1	0.3				
Maximum	1.3	0.2	-0.1	0.3	1.1	0.3	0	0.3				

Location	U C L				U C L				U C L			
Depth	0.9				.05				0.5			
Vector	S	A	V		S	A	V		S	A	V	
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
Minimum Average												
Maximum												

Notes:

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation [illegible]
Canal Flow 1100cfs

Date [illegible]
Personnel CK/PBT

Screen Diameter (in) [illegible]
Exposed (in) [illegible]
Submerged (in) [illegible]

Screen # 12

Time Start	1221			
Time End	1225			
Unit	823		[illegible]	
Location	U	C	L	
Depth	0.2			
Vector	S	A	-V	A
1	1.3	0.2	0.1	0.3
2	1.3	0.2	0.1	0.3
3	1.3	0.2	0.1	0.5
4	1.2	0.2	0.1	0.3
5	1.3	0.2	0.1	0.3
6	1.2	0.2	0.1	0.3
7	1.3	0.2	0.1	0.3
8	1.3	0.2	0.1	0.3
9	1.3	0.2	0.1	0.3
10	1.2	0.1	0.1	0.3
Average	1.27	0.19	-0.10	0.30
Minimum	1.2	0.1	-0.1	0.3
Maximum	1.3	0.2	-0.1	0.3

Time Start	1221			
Time End	1225			
Unit	[illegible]		[illegible]	
Location	U	C	L	
Depth	0.8			
Vector	S	A	-V	A
1	1.0	0.2	-0.1	0.3
2	1.1	0.2	0.1	0.3
3	1.2	0.2	0	0.2
4	1.1	0.2	0.1	0.3
5	1.1	0.2	0.1	0.4
6	1.0	0.2	0	0.3
7	1.0	0.2	0.1	0.3
8	1.0	0.1	0	0.3
9	1.1	0.2	0	0.3
10	1.1	0.2	0.1	0.3
Average	1.07	0.19	-.04	0.30
Minimum	1.0	0.1	-0.1	0.2
Maximum	1.2	0.2	0.1	0.4

Time Start			
Time End			
Unit			
U	C	L	
0.08a			
S	A	V	

Time Start			
Time End			
Unit			
U	C	L	
0.9			
S	A	V	

Time Start			
Time End			
Unit			
U	C	L	
05			
S	A	V	

Time Start			
Time End			
Unit			
U	C	L	
0.5			
S	A	V	

Notes:

Chandler Fish Screening Facility Flow Measurements

Screen # 13

Screen Diameter (in) 162
Exposed (in) [illegible]
Submerged (in) 108

Forebay Elevation [illegible]
Canal Flow 1100 cfs

Date 7/2[illegible]/80
Personnel [illegible]

Time Start	1215		1215									
Time End	1215		1219									
Unit	823	[illegible]	[illegible]	818								

Location	U (C) L				U (C) L			
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	1.1	0.1	0.1	0.3	1.0	0.2	0.1	0.4
2	1.1	0.1	0.2	0.3	1.1	0.3	0.1	0.3
3	1.1	0.1	0.1	0.3	1.1	0.2	0	0.3
4	1.0	0.1	0.1	0.3	1.0	0.2	0	0.3
5	1.0	0.1	0.1	0.3	1.1	0.2	0	0.3
6	1.1	0.1	0.2	0.3	1.0	0.2	-0.1	0.2
7	1.1	0.1	0.1	0.3	1.1	+0.2	0.1	0.3
8	1.0	0.1	0.1	0.3	1.1	0.2	0.1	0.3
9	1.0	0.1	0.1	0.3	1.2	0.2	0.1	0.3
10	0.9	0.1	0.1	0.3	1.0	0.2	0	0.3
Average	1.04	0.10	-0.12	0.30	1.07	0.21	-0.04	0.30
Minimum	0.9	0.1	-0.2	0.3	1.0	0.2	-0.1	0.2
Maximum	1.1	0.1	-0.1	0.3	1.2	0.3	0.1	0.4

Location	U C L				U C L				U C L				U C L			
Depth	0.08a				0.9				.05				0.5			
Vector	S	A	V		S	A	V		S	A	V		S	A	V	
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
Average																
Minimum																
Maximum																

Notes:

C.15

C.16

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 530.1
Canal Flow 1100 cfs

Date 7/26/90
Personnel [illegible] FRT

Screen # 14

Screen Diameter (in) 162
Exposed (in) 54
Submerged (in) 108

Time Start	1209		1209									
Time End	1212		1212									
Unit	923	920	924	918								

Location	U C L				U C L				U C L				U C L				U C L				U C L			
Depth	0.2				0.8				0.08a				0.9				.05				0.5			
Vector	S	A	-V	A	S	A	-V	A	S	A	V		S	A	V		S	A	V		S	A	V	
1	1.2	0.2	0.1	0.3	1.0	0.1	0	0.3																
2	1.2	0.2	0.1	0.3	0.9	0.2	0	0.3																
3	1.2	0.2	0.1	0.3	1.1	0.2	0	0.3																
4	1.3	0.2	0.1	0.3	1.0	0.2	0	0.3																
5	1.3	0.2	0.1	0.3	0.9	0.2	0	0.3																
6	1.3	0.2	0.1	0.3	1.1	0.2	0	0.3																
7	1.2	0.2	0.1	0.3	1.1	0.2	0	0.3																
8	1.2	0.2	0.1	0.3	0.9	0.1	0	0.3																
9	1.3	0.2	0.1	0.3	1.0	0.2	0.1	0.3																
10	1.2	0.2	0.1	0.3	1.0	0.2	0	0.3																
Average	1.24	0.20	-0.10	0.30	1.00	0.18	0.01	0.30																
Minimum	1.2	0.2	-0.1	0.3	0.9	0.1	-0.1	0.3																
Maximum	1.3	0.2	-0.1	0.3	1.1	0.2	0	0.3																

Notes:

C.17

Chandler Fish Screening Facility Flow Measurements

Screen # 15

Screen Diameter (in) 162
Exposed (in) 54
Submerged (in) 108

Forebay Elevation 7/26 630.1 - 7/27 630.0
Canal Flow 1100 - 1037 cfs

Date 7/26-27/89
Personnel [illegible]

Time Start	1202 7/26	1202 7/26	1157 7/27	1157 7/27	0957 7/27	0957 7/27
Time End	1206	1206	1200	1200	1001	1001
Unit						

Location	U C L				U C				u c L			
Depth	0.2				0.8				0.08a			
Vector	S	A	-V	A	S	A	-V	A	S	A	-V	A
1	1.0	0.2	0	0.4	0.9	0.2	0	0.3	1.1	0.4	-0.1	0.6
2	1.0	0.2	0.1	0.4	1.1	0.2	0	0.3	0.9	0.3	-0.1	0.5
3	1.0	0.2	0.1	0.4	1.0	0.2	0	0.4	1.1	0.3	-0.1	0.5
4	1.0	0.1	0.1	0.4	1.0	0.2	-0.1	0.4	1.0	0.4	-0.1	0.5
5	1.0	0.2	0	0.4	0.8	0.2	0	0.3	1.1	0.3	-0.1	0.4
6	1.0	0.1	0	0.4	1.0	0.2	-0.1	0.3	1.0	0.3	-0.1	0.5
7	1.1	0.2	0.1	0.4	0.9	0.2	0	0.3	1.2	0.4	0	0.5
8	1.1	0.2	0	0.4	1.0	0.2	0	0.3	1.1	0.4	-0.1	0.4
9	1.1	0.1	0.1	0.4	1.1	0.2	0	0.3	1.2	0.4	-0.1	0.5
10	0.9	0.1	0.1	0.4	1.0	0.3	0	0.4	1.1	0.3	-0.1	0.4
Average	1.02	0.16	-0.06	0.40	0.98	0.21	-0.02	0.32	1.08	0.35	0.09	0.48
Minimum												
Maximum												

Location	U C L				U C L				U C L			
Depth	0.9				.05				0.5			
Vector	S	A	-V	A	S	A	-V	A	S	A	-V	A
1	0.7	0.4	-0.1	0.5	1.3	0.2	0	[illegible]	1.2	0.3	0.1	0.4
2	0.7	0.4	-0.1	0.5	1.3	0.3	0.1	0.3	1.1	0.2	0.1	0.4
3	0.8	0.4	-0.1	0.5	1.2	0.2	0.1	[illegible]	1.2	0.2	0	0.3
4	0.7	0.4	-0.1	0.5	1.3	0.1	0.1	0.2	1.1	0.2	0.1	0.4
5	0.8	0.4	-0.1	0.5	1.3	0.2	0.1	0.3	1.2	0.2	0	0.4
6	0.7	0.4	-0.1	0.5	1.3	0.2	0	[illegible]	1.1	0.2	0.1	[illegible]
7	1.0	0.4	-0.1	0.5	1.2	0.2	0.1	[illegible]	[illegible]	[illegible]	0.1	0.3
8	0.8	0.4	-0.1	0.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0.4
9	[illegible]	0.3	-0.1	0.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.3
10	0.8	0.4	-0.1	0.5	[illegible]	0.2	[illegible]	[illegible]	1.1	0.2	0	0.4
Average	0.77	0.39	0.10	0.50	1.27	0.20	-0.08	0.31	1.12	0.22	-0.04	0.36
Minimum												
Maximum												

Notes:

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 7/26 630.1 – 7/27 630.0

Canal Flow 1100 - 1037 cfs

Date 7/26-27/89

Personnel Cox/DBS

Screen # 16

Screen Diameter (in) 162

Exposed (in) 54

Submerged (in) 108

Time Start	1156 7/26	1156 7/26	1313 7/27		0949 7/27	0949 7/27
Time End	1200	1200	131[illegible]		0953	0953
Unit						

Location	U C L				U C L				U C L			
Depth	0.2				0.8				0.08a			
Vector	S	A	-V	A	S	A	-V	A	S	A	-V	A
1	1.2	0.2	0	0.4	0.9	0.2	-0.3	0.3	1.1	0.5	-0.1	0.6
2	1.2	0.2	0.	0.	0.9	0.2	-0.3	0.3	1.0	0.5	-0.1	0.6
3	1.2	0.3	0	0.4	1.0	0.1	-0.4	0.3	1.0	0.4	-0.2	0.6
4	1.2	0.3	0	0.4	1.0	0.1	-0.3	0.3	0.9	0.4	-0.2	0.4
5	1.2	0.2	0.1	0.4	0.9	0.2	-0.3	0.4	1.3	0.4	-0.1	0.6
6	1.1	0.2	0.1	0.4	0.9	0.2	-0.3	0.3	1.1	0.5	-0.1	0.6
7	1.1	0.2	0	0.4	0.9	0.1	-0.4	0.3	1.1	0.5	-0.1	0.6
8	1.2	0.3	0	0.4	0.9	0.2	-0.3	0.4	1.1	0.4	-0.1	0.6
9	.2	0.3	0	0.4	0.9	0.2	-0.3	0.3	1.1	0.4	-0.2	0.6
10	1.2	0.2	0	0.4	0.9	0.2	-0.4	0.3	1.2	0.4	[illegible]	0.5
Average	1.18	0.24	0.03	0.40	0.91	0.17	0.33	0.32	1.19	0.44	0.13	0.58
Minimum												
Maximum												

Location	U C L				U C L				U C L			
Depth	0.9				.05				0.5			
Vector	S	A	V		S	A	-V	A	S	A	-V	A
1					1.3	0.5	-0.1	0.4	1.1	0.3	0	0.4
2					1.1	0.2	0	0.4	1.1	0.2	-0.1	0.3
3					1.1	0.3	0.1	0.4	1.1	0.2	0	0.4
4					1.1	0.3	0.1	0.4	1.0	0.2	-0.1	0.4
5					1.2	0.2	0.1	0.4	1.0	0.2	0	0.4
6					1.1	0.2	0	0.4	1.1	0.3	0	0.4
7					[illegible]	0.2	0.1	0.4	1.0	0.3	-0.1	0.4
8					1.0	0.2	0.1	0.4	[illegible]	0.2	[illegible]	0.4
9					1.1	0.3	0.1	[illegible]	1.0	0.3	0	0.4
10					1.2	0.3	0.1	[illegible]	1.1	0.2	0	0.4
Average					1.14	0.27	-0.06	0.40	1.06	0.24	0.04	0.39
Minimum												
Maximum												

Notes: Large obstruction under Screen - No 0.9 Z [illegible] 7/27/89

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 7/26 630.1 – 7/27 633.0
Canal Flow 1100 – 1037cfs

Date 7/26-27/89
Personnel CGG/PBF

Screen # 17

Screen Diameter (in) 16.2
Exposed (in) 5.1
Submerged (in) 10.8

Time Start	1148 7/26	1148 7/26	1141 7/27	1141 7/27	0942 7/27	0942 7/27
Time End	1152	1152	1146	[illegible]	[illegible]	[illegible]
Unit						

Location	U C L				U C L			
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	1.2	0.4	0.1	0.5	0.8	0.6	0	0.7
2	1.2	0.4	0.1	0.5	0.9	0.7	0.1	0.8
3	1.3	0.4	0.2	0.5	1.0	0.6	0.1	0.8
4	1.3	0.4	0.1	0.5	0.9	0.6	0	0.7
5	1.2	0.4	0.1	0.5	0.8	0.7	0.1	0.8
6	1.3	0.4	0.1	0.5	0.8	0.6	0	0.7
7	1.3	0.4	0.1	0.5	0.8	0.6	0.1	0.8
8	1.3	0.4	0.1	0.5	0.9	0.7	0.1	0.7
9	1.4	0.5	0.1	0.5	0.9	0.6	0.1	0.7
10	1.2	0.4	0.2	0.5	0.8	0.7	0	0.7
Average	1.27	0.41	-0.12	0.50	0.86	0.64	-0.06	0.74
Minimum								
Maximum								

Location	U C L				U C L			
Depth	0.08a				0.9			
Vector	S	A	-V	A	S	A	-V	A
1	0.9	0.6	0.2	0.9	0.7	0.7	0	0.9
2	1.0	0.6	0.1	0.8	0.7	0.7	0	0.8
3	1.0	0.7	0.1	0.8	0.6	0.7	0	0.8
4	1.0	0.6	0.1	0.8	0.6	0.6	-0.1	0.8
5	0.7	0.6	0.2	0.8	0.6	0.7	0	0.8
6	1.0	0.6	0.2	0.8	0.6	0.7	0	0.9
7	0.9	0.6	0.2	0.9	0.7	0.7	0	0.8
8	0.9	0.6	0.2	0.9	0.6	0.8	0	0.8
9	0.8	0.7	0.1	0.9	0.6	0.7	0	0.8
10	0.8	0.6	0.1	0.8	0.6	0.7	0	0.9
Average	0.97	0.62	0.15	0.83	0.63	0.70	0.01	0.83
Minimum								
Maximum								

Location	U C L				U C L			
Depth	.05				0.5			
Vector	S	A	-V	A	S	A	-V	A
1	1.3	0.3	0.1	0.5	1.0	0.4	0.2	0.6
2	1.2	0.2	0.1	0.5	0.8	0.5	0.1	0.6
3	1.2	0.3	0.1	0.5	[illegible]	0.5	0.2	0.6
4	1.3	0.3	0.1	0.5	0.8	0.5	0.2	0.6
5	0.9	0.1	0.1	0.5	1.0	0.5	0.2	0.6
6	1.2	0.3	0.1	0.5	0.9	0.5	0.2	0.5
7	1.2	[illegible]	[illegible]	0.5	1.0	0.4	0.1	0.6
8	1.1	0.3	0.1	0.5	[illegible]	0.4	0.2	[illegible]
9	1.1	0.3	0.1	0.5	[illegible]	0.4	0.1	0.6
10	1.1	0.3	0.1	0.5	[illegible]	[illegible]	0.2	0.6
Average	1.26	0.27	-0.10	0.50	0.88	0.46	-0.17	0.59
Minimum								
Maximum								

Notes:

C.19

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation [illegible]
Canal Flow 1100 cfs

Date 7/26/95
Personnel [illegible]/FFT

Screen # 18

Screen Diameter (in) 168
Exposed (in) 60
Submerged (in) 108

Time Start	1142		1142									
Time End	1146		1146									
Unit	823	1020	824	818								

Location	U	C	L		U	C	L		U	C	L		U	C	L		U	C	L		U	C	L	
Depth	0.2				0.8				0.08a				0.9				.05				0.5			
Vector	S	A	-V	A	S	A	-V	A	S	A	V		S	A	V		S	A	V		S	A	V	
1	1.1	0.2	0.2	0.4	1.0	0.4	0.1	0.5																
2	1.2	0.2	0.1	0.4	1.0	0.4	0	0.5																
3	1.3	0.2	0.2	0.4	1.0	0.4	0.1	0.5																
4	1.2	0.2	0.1	0.3	1.0	0.4	0	0.5																
5	1.1	0.3	0.1	0.4	1.0	0.4	0	0.5																
6	1.1	0.2	0.1	0.4	1.0	0.4	0.1	0.6																
7	1.2	0.3	0.2	0.4	1.0	0.4	0.1	0.4																
8	1.1	0.2	0.1	0.4	0.9	0.4	0	0.4																
9	1.3	0.3	0.1	0.4	1.0	0.4	0.1	0.5																
10	1.2	0.2	0.1	0.4	0.9	0.4	0	0.5																
Average	1.18	0.23	-0.15	0.39	0.98	0.40	-0.05	0.49																
Minimum	1.1	0.2	-O.t	0.3	0.9	0.4	-0.1	0.4																
Maximum	1.3	0.3	-0.1	0.4	1.0	0.4	0	0.6																

Notes:

C.20

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation [illegible]
Canal Flow 1100 cfs

Date [illegible]/89
Personnel [illegible]

Screen # 19

Screen Diameter (in) [illegible]
Exposed (in) [illegible]
Submerged (in) 3 [illegible]

Time Start	1117		1117									
Time End	1121		1121									
Unit	823	1020	824	818								

Location	U (C) L				U (C) L			
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	1.2	0.3	0.1	0.4	1.1	0.3	0.1	0.4
2	1.2	1.3	0.1	0.4	0.9	0.3	0.1	0.5
3	1.2	0.3	0	0.4	1.0	0.3	0	0.4
4	1.2	0.3	0.1	0.4	1.1	0.4	0.1	0.5
5	1.2	0.3	0.1	0.4	1.0	0.4	0.1	0.6
6	1.1	0.3	0.2	0.4	0.9	0.4	0.1	0.5
7	1.1	0.3	0.2	0.4	0.9	0.4	0	0.5
8	1.1	0.3	0.2	0.4	1.1	0.4	0.1	0.4
9	1.2	0.2	0.1	0.4	1.1	0.4	0.1	0.5
10	1.2	0.3	0.1	0.5	1.1	0.4	0.1	0.5
Average	1.17	0.29	-0.12	0.41	1.02	0.37	-0.08	0.48
Minimum	1.1	0.2	-0.2	0.4	0.9	0.3	-0.1	0.4
Maximum	1.2	0.3	0	0.5	1.1	0.4	0	0.6

Location	U C L				U C L				U C L				U C L			
Depth	0.08a				0.9				.05				0.5			
Vector	S	A	V		S	A	V		S	A	V		S	A	V	
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
Average																
Minimum																
Maximum																

Notes:

C 21

Chandler Fish Screening Facility Flow Measurements

Screen # 20

Screen Diameler (in) 162
Exposed (in) 54
Submerged (in) 108

Forebay Elevation 630.1
Canal Flow- 1100 cfs

Dale 7/26/89
Personnel [illegible]

Time Start	1110				1110			
Time End	1114				1114			
Unit	823		1020		824		812	
Location	U C L				U C L			
Depth	0.2				0.8			
Vector	S	A	–V	A	S	A	–V	A
1	0.7	0.3	0.1	0.4	0.9	0.4	0.1	0.5
2	1.1	0.2	0.1	0.4	1.0	0.4	0	0.5
3	0.8	0.3	0.1	0.4	1.1	0.4	0.1	0.5
4	0.9	0.2	0.3	0.4	1.0	0.5	0.1	0.5
5	1.1	0.3	0.2	0.4	0.9	0.4	0	0.5
6	1.2	0.3	0	0.4	0.9	0.4	0.1	0.4
7	1.0	0.2	0.2	0.4	0.9	0.4	0.1	0.4
8	1.0	0.2	0.1	0.4	0.9	0.4	0	0.5
9	1.1	0.3	0	0.4	0.8	0.3	0.1	0.5
10	1.0	0.3	0.1	0.4	1.0	0.4	0.1	0.5
Average	0.99	0.26	-0.12	0.40	0.94	0.40	-0.07	0.48
Minimum	0.7	0.2	-0.3	0.4	0.8	0.3	-0.1	0.4
Maximum	1.2	0.3	0	0.4	1.1	0.5	0	0.5

Location	U C L				U C L				U C L				U C L			
Depth	0.08a				0.9				.05				0.5			
Vector	S	A	V		S	A	V		S	A	V		S	A	V	

Notes: Erratic Sweep/Approach at 0.2 ft

C.22

Chandler Fish Screening Facility Flow Measurements

Screen # 21

Screen Diameter (in) 162
Exposed (in) 54
Submerged (in) 28

Forebay Elevation 535.1
Canal Flow 1100 cfs

Date 7/26/89
Personnel ?la ?FBT

Time Start	1104		1104									
Time End	1107		1107									
Unit	923	1020	824	818								

Location	U C L				U C L				U C L				U C L				U C L				U C L			
Depth	0.2				0.8				0.08a				0.9				.05				0.5			
Vector	S	A	-V	A	S	A	-V	A	S	A	V		S	A	V		S	A	V		S	A	V	
1	1.2	0.1	0.2	0.4	0.9	0.4	0.1	0.5																
2	1.2	0.3	0.1	0.4	0.8	0.5	0.1	0.6																
3	1.3	0.2	0.1	0.4	0.8	0.5	0	0.5																
4	1.2	0.2	0.2	0.4	0.8	0.4	0.1	0.5																
5	1.2	0	0.1	0.4	0.7	0.4	0.1	0.5																
6	1.3	0.2	0.1	0.4	0.8	0.4	0.1	0.4																
7	1.3	0.1	0.1	0.4	0.9	0.4	0.1	0.4																
8	1.3	0.2	0.1	0.4	0.8	0.4	0	0.5																
9	1.2	0.2	0.1	0.4	0.7	0.5	0	0.6																
10	1.3	0.3	0.1	0.4	0.8	0.4	0	0.6																
Average	1.25	0.18	-0.12	0.40	0.80	0.43	-0.06	0.52																
Minimum	1.2	0	-0.2	0.4	0.7	0.4	-0.1	0.4																
Maximum	1.3	0.3	-0.1	0.4	0.9	0.5	0	0.6																

Notes: Erratic readings at 0.2 ? (periodic)

C.23

Chandler **Fish Screening Facility Flow Measurements**

Screen # 22

Screen Diameter (in) 162
Exposed (in) 54
Submerged (in) 108

Forebay Elevation 630.1
Canal **Flow** 1100 cfs

Date 7/26-27/89
Personnel [illegible]

Time Start	1056	1056	1132	1132	0934	0934
Time End	1100	1100	1137	1137	0937	0938
Unit						

Location	U C L				U C L				U C L			
Depth	0.2				0.8				0.08a			
Vector	S	A	-V	A	S	A	-V	A	S	A	V	
1	1.1	0.5	0	0.5	0.6	0.5	0	0.5	1.0	0.5	0.1	0.7
2	0.9	0.5	0.2	0.5	0.7	0.5	0	0.4	1.0	0.6	0.1	0.7
3	1.0	0.5	0.1	0.5	0.8	0.5	0	0.6	0.9	0.5	0.1	0.6
4	1.0	0.3	0.2	0.5	0.6	0.5	0	0.6	1.2	0.5	0.1	0.7
5	1.1	0.3	0.1	0.5	0.7	0.5	0.1	0.6	0.9	0.5	0.1	0.7
6	1.1	0.5	0.1	0.5	0.6	0.6	0	0.6	0.9	0.6	0	0.7
7	1.1	0.4	0.1	0.5	0.7	0.4	0.1	0.6	1.0	0.6	0.1	0.7
8	1.0	0.4	0.1	0.5	0.6	0.4	-0.1	0.5	1.0	0.5	0	0.6
9	1.1	0.3	0.1	0.5	0.5	0.5	0	0.5	1.0	0.5	0.1	0.7
10	1.1	0.3	0.1	0.5	0.7	0.4	0	0.5	1.0	0.5	0	0.6
Average	1.05	636	-0.11	0.50	0.65	0.48	-0.01	0.54	0.97	0.53	-0.07	0.67
Minimum												
Maximum												

Location	U C L				U C L				U C L			
Depth	0.9				.05				0.5			
Vector	S	A	V		S	A	-V	A	S	A	-V	A
1	0.8	0.6	0	0.8	1.1	0.2	0.1	0.4	0.9	0.4	0.1	0.5
2	0.6	0.6	-0.1	0.7	1.1	0.2	0.1	0.4	0.9	0.4	0.1	0.5
3	0.7	0.6	-0.1	0.6	1.0	0.2	0.1	0.4	0.9	0.3	0	0.4
4	0.7	0.7	0	0.9	1.2	0.2	0.1	0.4	0.8	0.4	0	0.5
5	0.6	0.6	-0.1	0.7	1.2	0.2	0.1	0.4	0.9	0.4	0.1	0.5
6	0.5	0.6	-0.1	0.7	1.2	0.3	0.1	0.4	1.0	0.4	0	0.5
7	0.6	0.6	-0.1	0.7	1.2	0.3	0.1	0.4	1.0	0.4	0.1	0.5
8	0.5	0.5	-0.1	0.7	1.2	0.2	0.1	0.4	0.9	0.3	0.1	0.5
9	0.5	0.6	-0.1	0.8	1.2	0.4	0.1	0.4	0.9	0.3	0.1	0.5
10	[illegible]	[illegible]	-0.1	0.8	1.1	0.2	0.1	0.4	[illegible]	0.4	0	0.4
Average	0.58	0.60	0.08	0.74	1.15	0.24	-0.10	0.4[illegible]	0.90	0.36	-0.06	0.48
Minimum												
Maximum												

Notes: Erratic readings at 0.2 ≥ some of the time esa 7/26/89

C.24

C.25

Chandler Fish Screening Facility Flow Measurements

Screen # 24

Screen Diameter (in) 162"
Exposed (in) 54"
Submerged (in) 108"

	7/26/89	7/27/89
Forebay Elevation	630.1	630.0
Canal Flow	1100 –	1037 cfs

Date 7/26/89
Personnel cta / PBT

Time Start	1046 7/26		1046 7/26		1124 7/27		1124 7/27		0926 7/27		0926 7/27	
Time End	1051		1051		1129		1129		09??		[illegible]	
Unit	823	1020	824	818	823	1020	824	818	823	1020	824	818

Location	U C L				U C L				U C L			
Depth	0.2				0.8				0.08a			
Vector	S	A	-V	A	S	A	-V	A	S	A	-V	A
1	1.1	0.3	-0.1	0.5	0.9	0.4	0	0.5	1.2	0.6	0	0.7
2	0.9	0.4	0.1	0.5	1.0	0.4	0	0.5	1.1	0.5	0	0.7
3	0.8	0.3	0.1	0.5	0.9	0.5	0	0.5	1.2	0.6	0	0.7
4	1.1	0.3	0.1	0.5	1.0	0.4	0.2	0.5	1.1	0.5	0	0.6
5	0.8	0.3	0.1	0.5	1.0	0.4	0.0	0.5	1.2	0.5	0	0.7
6	1.0	0.3	0.2	0.5	0.9	0.5	0	0.5	1.1	0.6	0.1	0.7
7	1.2	0.3	0.1	0.5	0.8	0.5	0	0.5	1.2	0.6	0.1	0.8
8	1.1	0.2	0.1	0.5	1.0	0.4	0	0.5	1.2	0.6	0	0.7
9	1.0	0.4	0.2	0.5	1.0	0.4	-0.2	0.5	[illegible]	0.6	-0.1	0.7
10	0.6	0.3	0.1	0.4	0.9	0.4	0.2	0.5	1.1	0.6	0	0.7
Average	0.97	0.31	-0.10	0.49	0.94	0.43	-0.02	0.50	1.16	0.57	-0.01	0.70
Minimum												
Maximum												

Location	U C L				U C L				U C L			
Depth	0.9				.05				0.5			
Vector	S	A	-V	A	S	A	-V	A	S	A	-V	A
1	1.1	0.6	-0.1	0.6	1.2	0.3	0.1	0.5	1.0	0.3	0	0.4
2	1.0	0.6	-0.1	0.7	1.3	0.3	0.1	0.5	1.1	0.4	0.1	0.5
3	0.9	0.6	-0.1	0.7	1.2	0.3	0.1	0.5	1.1	0.4	0.1	0.6
4	1.0	0.6	-0.1	0.7	1.3	0.3	0.1	0.5	1.1	0.4	0	0.5
5	1.0	0.6	-0.1	0.6	1.2	0.3	0.1	0.5	1.0	0.4	0.1	0.5
6	1.0	0.6	-0.1	0.7	1.3	0.3	0.1	0.5	1.0	0.5	0	0.6
7	1.2	0.6	-0.1	0.8	1.2	0.3	0.1	0.5	1.0	0.3	0	0.5
8	0.9	0.6	-0.2	0.7	1.2	0.3	0.1	0.5	1.0	0.4	0.1	0.5
9	1.0	0.6	0	0.7	1.1	0.3	0	0.5	1.0	0.4	0.1	0.5
10	1.0	0.6	-0.1	[illegible]	1.1	0.3	0.1	0.5	1.0	0.4	0	0.5
Average	1.01	0.60	0.10	0.69	1.21	0.31	-0.10	0.50	1.03	0.39	-0.05	0.51
Minimum												
Maximum												

Notes: 823: X = +A, Y = +S
824: X = -A, Y = -S

1020: X = -V, Y = +A
818: X = -V, Y = +A

Erratic readings period ically at 0.2 Z (turbulence?)

Screen #23 out of service.

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 630.1
Canal Flow 1100 cfs

Date 7/26/94
Personnel [illegible] / PB T

~~Screen~~ Bypass # 1

Screen Diameter (in)
Exposed (in)
Submerged (in)

Time Start	1412		1412									
Time End	1417		1417									
Unit	923	1020	924	818								

Location	U C L				U C L				U C L			
Depth	0.2				0.8				0.08a			
Vector	S	A	-V	A	S	+A	-V	A	S	A	V	
1	2.0	-0.1	-0.2	0	1.3	0.3	-0.2	0.2				
2	1.9	0	-0.2	0.1	1.3	0.3	-0.2	0.1				
3	2.0	-0.1	-0.1	-0.1	1.2	0.2	-0.2	0.3				
4	2.0	-0.1	-0.1	-0.1	1.3	0.3	-0.2	0.2				
5	2.0	-0.1	-0.1	0	1.2	0.2	-0.3	0.1				
6	2.0	0	-0.1	0	1.1	0.2	-0.2	0.2				
7	1.9	0	0	0	1.1	0.2	-0.2	0.1				
8	2.0	-0.1	-0.1	-0.1	1.2	0.3	-0.2	0.1				
9	2.0	0	-0.1	-0.1	1.0	0.2	-0.2	0.2				
10	2.0	-0.1	-0.1	-0.1	1.1	0.2	-0.2	0.1				
Average	1.18				1.16							
Minimum												
Maximum												

Location	U C L				U C L				U C L			
Depth	0.9				.05				0.5			
Vector	S	A	V		S	A	V		S	A	V	
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
Average												
Minimum												
Maximum												

Notes:

824 = +x = +A
+y = S
818 +x = V
y = +A

+A is upstream

C.26

C.27

Chandler Fish Screening Facility Flow Measurements

~~Screen #~~ BYPASS 2

Screen Diameter (in) ____
Exposed (in) ____
Submerged (in) ____

Forebay Elevation 630.1
Canal Flow 1100 cfs

Date [illegible]
Personnel JCJ / RBT

	Block 1		Block 2		Block 3		Block 4		Block 5		Block 6	
Time Start	1425		1425									
Time End	1430		1430									
Unit	223	1020	824	818								

Location	U C L				U C L			
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	1.8	0	-0.2	-0.1	1.4	-0.2	-0.3	0
2	1.7	-0.1	-0.2	0	1.4	-0.3	-0.3	-0.1
3	1.8	0	-0.1	0	1.5	-0.2	-0.3	0
4	1.7	0	-0.2	0	1.6	-0.2	-0.3	0
5	1.8	0	-0.2	0	1.6	-0.2	-0.3	-0.1
6	1.7	0	-0.2	0.1	1.3	-0.2	-0.4	-0.1
7	1.7	0	-0.2	0	1.5	-0.3	-0.3	0
8	1.7	0	-0.2	0.1	1.4	-0.2	-0.3	0
9	1.7	0	-0.2	0	1.6	-0.3	-0.3	-0.1
10	1.7	-0.1	-0.2	0	1.6	-0.3	-0.3	-0.1
Average	1.73				1.49			
Minimum								
Maximum								

Location	U C L				U C L				U C L				U C L			
Depth	0.08a				0.9				.05				0.5			
Vector	S	A	V		S	A	V		S	A	V		S	A	V	
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
Average																
Minimum																
Maximum																

Notes:

Chandler Fish Screening Facility Flow Measurements

BYPASS ~~Screen #~~ 3

Screen Diameter (in) ____
Exposed (in) ____
Submerged (in) ____

Forebay Elevation [illegible]
Canal Flow 1100 cfs

Date [illegible]
Personnel [illegible]

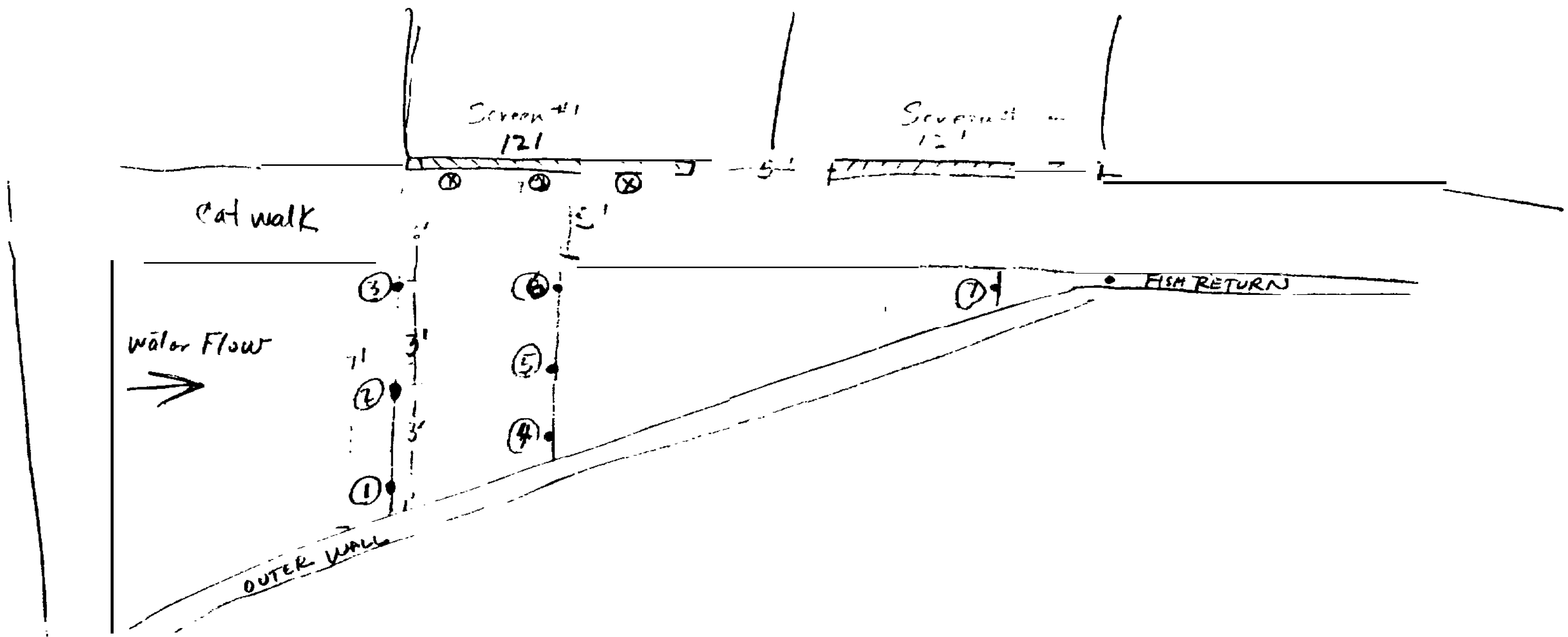
Time Start	1437		1437								
Time End	1442		1442								
Unit	823	1020	824	818							

Location	U C L				U C L				U C L				U C L				U C L				U C L			
Depth	0.2				0.8				0.08a				0.9				.05				0.5			
Vector	S	A	-V	A	S	A	-V	A	S	A	V		S	A	V		S	A	V		S	A	V	
1	1.4	-0.1	-0.2	-0.2	1.2	-0.3	-0.4	-0.4																
2	1.4	-0.1	-0.2	0	1.2	-0.3	-0.5	-0.6																
3	1.4	-0.1	-0.2	0	1.3	-0.3	-0.5	-0.5																
4	1.4	0	-0.2	0	1.3	-0.4	-0.5	-0.5																
5	1.3	-0.1	-0.3	-0.1	1.3	-0.2	-0.5	-0.5																
6	1.4	-0.1	-0.2	0	1.2	-0.3	-0.5	-0.5																
7	1.4	0	-0.2	0.1	1.2	-0.3	-0.5	-0.6																
8	1.3	0	-0.2	0.1	1.3	-0.2	-0.4	-0.5																
9	1.4	0	-0.2	-0.1	1.3	-0.2	-0.5	-0.7																
10	1.4	-0.1	-0.3	-0.1	1.3	-0.4	-0.4	-0.6																

Average	[illegible]	0.06	0.24		1.26																			
Minimum																								
Maximum																								

Notes:

C.28


Screen #1
12'
12'
Cat walk
Water Flow
3'
3'
FISH RETURN
OUTER WALL
1
2
3
4
5
6
7

C.30

Chandler Fish Screening Facility Flow Measurements

Sep chamber, ~~Screen #~~ Upper Transect

Screen ~~Diameter~~ (in) ______
~~Exposed~~ (in) ______
~~Submerged~~ (in) ______

Forebay Elevation 630.0 (Screens) 627.5 (Sep chamber.
Canal Flow 1[illegible]30 cfs

Date 7/25/89
Personnel [illegible] / FFT

Time Start	1005			
Time End	1011			
Unit				
Location	1 (U C L)			
Depth	0.2			
Vector	S	A	–V	A
1	1.9	0.5	0.3	0.6
2	1.6	0.3	0.2	0.4
3	1.7	0.2	0.4	0.2
4	1.4	0.8	0.6	0.4
5	1.4	0.4	0.2	0.3
6	1.6	0.7	0.5	0.6
7	2.1	-0.1	0.5	0.5
8	1.5	0.6	0.6	1.0
9	1.9	0.4	0.4	0.5
10	1.6	0.5	0.2	0.7
Average	1.7	[illegible]	-0.39	0.52
Minimum				
Maximum				

Time Start	1005			
Time End	1011			
Unit				
Location	1 (U C L)			
Depth	0.8			
Vector	S	A	–V	A
1	-0.2	0.2	-0.1	0.3
2	-0.1	0.1	0	0
3	-0.2	0.1	-0.1	0.4
4	0.5	0.2	0	0.1
5	0.1	0.5	0.1	0.2
6	0	0.3	-0.1	0.1
7	0.3	0.4	0.2	0.1
8	-0.4	0.6	0.2	0.8
9	0.1	0.2	0.1	0.1
10	-0.1	0.1	-0.2	0.7
Average	0	0.27	-0.01	0.28
Minimum				
Maximum				

Time Start	1018			
Time End	1022			
Unit				
Location	2 (U C L)			
Depth	~~0.08a~~ 0.2			
Vector	S	A	–V	A
1	1.6	0.0	0.1	0.2
2	2.0	0.3	-0.1	0.5
3	1.7	0.3	0.2	0.1
4	1.6	0	0.3	0.1
5	1.3	-0.1	0.1	0.2
6	1.8	-0.4	-0.2	0.2
7	2.0	0.5	0.5	0.5
8	1.8	0	0.2	0.2
9	1.9	-0.1	0.5	-0.3
10	1.7	0.2	0.4	0.2
Average	1.76	-0.07	-0.24	0.19
Minimum				
Maximum				

Time Start	1018			
Time End	1022			
Unit				
Location	2 (U C L)			
Depth	~~0.9~~ 0.8			
Vector	S	A	–V	A
1	-0.3	-0.2	0	-0.1
2	-0.3	0.4	0	0.3
3	0.1	0	0.4	0.2
4	0	0.1	0.2	0.1
5	-0.3	0.2	0.2	0.4
6	0.3	0.3	0	0.5
7	-0.1	0.4	-0.1	0.1
8	0.1	0.5	0.6	0.6
9	0.3	-0.2	0.3	-0.1
10	0.3	0.1	0.4	-0.2
Average	0.01	0.14	-0.20	0.18
Minimum				
Maximum				

Time Start	1025			
Time End	1030			
Unit				
Location	3 (U C L)			
Depth	~~0.5~~ 0.2			
Vector	S	A	–V	A
1	2.0	-0.2	0.7	-0.5
2	1.8	-0.5	0.5	0.5
3	2.1	-0.8	0.4	-0.2
4	1.8	-0.3	0.2	-0.5
5	1.6	0.1	-0.3	-0.5
6	[illegible]	0	0.1	-0.3
7	1.9	-0.5	0.5	-0.5
8	1.8	-0.8	0.4	-0.4
9	2.[illegible]	0	0.2	-0.2
10	2.0	-0.6	0.4	-0.2
Average	1.90	-0.36	-0.36	-0.41
Minimum				
Maximum				

Time Start	1025			
Time End	1030			
Unit				
Location	3 (U C L)			
Depth	~~0.5~~ 0.8			
Vector	S	A	–V	A
1	-0.1	0.4	-0.1	0.7
2	0.2	0.4	0.3	0.5
3	0.3	0.1	0.4	0.3
4	-0.2	-0.1	0.1	0.2
5	-0.6	-0.1	-0.2	0.1
6	0	0.2	0.4	0.4
7	0.1	-0.1	0.5	0.1
8	0	0.4	0	0.5
9	[illegible]	[illegible]	[illegible]	[illegible]
10	0.4	0.4	0.3	0.6
Average	0.01	0.19	-0.18	0.40
Minimum				
Maximum				

Notes:

94" deep

0.2 = 19" from surface

0.8 = 75" from surface

Chandler Fish Screening Facility Flow Measurements

Screen # Sep Chamber	Screen Diameter (in)	Forebay Elevation: Canal 630.0, Sep Chamber 627.5	Date 7/28/89
	Exposed (in)	Canal Flow 1030 cfs	Personnel [illegible]
	Submerged (in)		

	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6
Time Start	1045	1045	1051	1051	1057	1057
Time End	1049	1049	1056	1056	[illegible]	[illegible]
Unit			3	5	6	6
Location	U C	U C	U C L	U C L	U C L	U C L
Depth	0.:	0.8	~~0.08~~ 0.2	~~0.9~~ 0.8	~~.05~~ 0.2	~~0.5~~ 0.8

Vector	S	A	V	A	S	A	V	A
1	2.2	0.1	0.4	0.2	0.4	3	0.5	0.1
2	1.7	0	0.2	[illegible]	0.4	0	[illegible]	-0.1
3	1.9	-0.1	0.0	0.2	0.7	0.5	0.2	0.4
4	1.7	0.7	0.2	0.2	0.2	0.3	0.1	0.3
5	1.6	0.1	0.4	0.2	0.4	0.1	0.2	0.2
6	[illegible]	0.3	0.4	0.1	0.7	0.3	0.2	0.3
7	1.8	0.3	0.2	0.3	0.8	0.4	0.2	0.6
8	1.2	0	0.2	0.2	0.4	0.4	0.3	0.3
9	1.9	0.5	0.2	0.3	0.3	0.2	0.4	0.2
10	1.9	0.3	0.3	0.3	0.7	0.1	0.2	0.4
Average	1.84	1.16	0.01	-0.20	0.073	0.23	-0.25	0.27
Minimum								
Maximum								

Vector	S	A	V	A	S	A	V	A
1	1.4	0.1	0.2	0.4	0.6	0.7	0.2	0.6
2	2.1	0	0.3	0	0.8	0.1	0.1	0.3
3	1.7	-0.3	0.4	-0.1	0.8	0.2	-0.2	0.4
4	1.9	0.1	0.3	0.3	-0.1	-0.2	-0.1	0
5	2.6	-0.2	0.3	-0.2	0.3	0.2	-0.1	0
6	2.1	-0.2	0.4	-0.1	0.4	0	0.1	0.2
7	1.9	0.1	0.1	0.4	0.3	0.4	0.3	0.6
8	1.8	-0.2	0.4	-0.1	0.9	0.3	0.4	0.3
9	1.8	0	0.3	-0.1	0.7	0.2	0	0.2
10	1.7	0.2	0	0.4	0.2	0.2	0.1	0.3
Average	1.87	-0.04	0.27	0.09	0.49	0.22	-0.08	0.30
Minimum								
Maximum								

Vector	S	A	V		S	A	V	
1	1.9	-0.1	0.1	0.1	0.2	0.2	-0.1	0.6
2	1.8	0.1	0.3	0	0.8	0.4	0	0.4
3	1.2	-0.1	0.3	0	0.4	0.1	0.2	0
4	1.9	0.2	0	0.1	0	0.3	0.1	0.5
5	1.1	0	0.1	[illegible]	0.4	0.3	0.1	0.5
6	1.5	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.2
7	[illegible]	-0.1	[illegible]	0	0	0.3	0	0.4
8	1.9	0.1	[illegible]	[illegible]	[illegible]	0.5	0.1	0.4
9	[illegible]	[illegible]	[illegible]	[illegible]	0.2	[illegible]	[illegible]	0.5
10	2.2	[illegible]	[illegible]	[illegible]	0	[illegible]	0.1	0.2
Average					0.32	0.31	-0.06	0.37
Minimum								
Maximum								

Notes:

C.31

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation: Canal 630.0 — Sep. Chamber 627.5

Canal Flow: 1030 cfs

Date: 7/28/89

Personnel: Clk/PBT

Sep chamber

~~Screen #~~ ________

Screen Diameter (in)________
Exposed (in)________
Submerged (in)________

Fish Return

Time Start	1108		1108		1121		1121					
Time End					1125		1125					
Unit												

7

Location	U C L			
Depth	0.2			
Vector	S	A	–V	A
1	1.5	0.2	0.2	0.2
2	1.8	0.4	0.1	0.1
3	1.8	1.3	0.3	0.4
4	1.6	0.3	0.2	0.4
5	1.7	0.3	0.2	0.3
6	1.6	0.2	0.2	0.4
7	1.8	0.2	0.2	0.4
8	1.4	0.2	0.2	0.3
9	1.6	0.3	0.2	0.2
10	1.6	0.2	0.3	0.1
Average	.64	0.26	-0.21	0.29
Minimum				
Maximum				

7

Location	U C L			
Depth	0.8			
Vector	S	A	–V	A
1	1.0	0.2	0.2	0.4
2	1.1	0.4	0.2	0.6
3	1.0	0.3	0.1	0.4
4	0.9	0.3	0.1	0.3
5	1.0	0.5	0.1	0.6
6	0.9	0.2	0.2	0.4
7	1.1	0.4	0.2	0.6
8	0.8	0.4	0.2	0.4
9	1.0	0.4	0.3	0.5
10	[illegible]	0.3	0.2	0.4
Average	0.99	0.35	-0.18	0.46
Minimum				
Maximum				

FR

Location	U C L			
Depth	~~0.08a~~ ~~0.2~~ 0.2			
Vector	S	A	–V	A
1	1.7	-0.1	0.1	0.1
2	1.5	-0.2	0	-0.1
3	1.9	0	0	0
4	1.6	-0.1	0	0.1
5	1.5	-0.1	0	-0.1
6	1.8	-0.1	0.1	0
7	1.7	-0.1	0.1	0
8	2.0	0	0	0
9	2.0	-0.1	0.1	0
10	1.8	0	0	0.1
Average	1.75	-0.08	-0.04	0.01
Minimum				
Maximum				

FR

Location	U C L			
Depth	~~0.9~~ 0.8			
Vector	S	A	–V	A
1	1.4	0.1	-0.2	0.1
2	1.2	0	0.2	-0.2
3	1.3	0	-0.1	0
4	1.3	0	-0.1	0
5	1.3	-0.1	0	-0.1
6	1.3	-0.1	-0.1	0.1
7	1.3	0	0	0
8	1.3	0	0.1	0.1
9	1.4	0	-0.1	0.1
10	1.5	0	-0.1	0.1
Average	1.33	-0.01	0.04	0.02
Minimum				
Maximum				

Location	U C L			
Depth	.05			
Vector	S	A	V	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Minimum				
Maximum				

Location	U C L			
Depth	0.5			
Vector	S	A	V	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Minimum				
Maximum				

Notes:

Chandler Fish Screening Facility Flow Measurements

Sep
, Screen # I

Screen Diameter (in)
Exposed (in)
Submerged (in)

Forebay Elevation Canal 630.0 Sep Chamber 627.5
Canal Flow 1030 cfs

Date 7/28/89
Personnel [illegible]

Time Start	1216				1216			
Time End	1221				1221			
Unit								
Location	U	C	L		U	C	L	
Depth	0.2				0.8			
Vector	S	A	-V	A	S	A	-V	A
1	0.9	0.1	-0.2	0.3	-0.2	0.2	-0.6	0.7
2	0.8	0.2	-0.3	0.4	0.4	0.1	0.1	0.1
3	0.5	0.2	-0.3	0.6	-0.2	0.2	-0.5	0.3
4	1.9	0.4	-0.2	0.4	-0.4	0.2	-0.3	0.3
5	1.0	0.2	-0.3	0.2	-0.1	0.3	-0.1	0.2
6	1.3	0.3	-0.[illegible]	0.5	0.2	0.2	-0.4	0.3
7	1.0	3.2	-0.3	0.3	-0.3	0.2	0.5	0.2
8	1.2	0.4	-0.2	0.5	-0.3	0.1	-0.3	0.2
9	1.3	0.2	-0.4	0.3	0.3	0.1	-0.2	0.1
10	1.0	0.2	-0.3	0.4	0.2	0.1	-0.1	0.2
Average	1.09	0.24	0.27	0.36	-0.05	0.17	0.29	0.21
Minimum								
Maximum								

Time Start	1225				1225			
Time End	1229				1229			
Unit								
Location	U	C	L		U	C	L	
Depth	~~.08~~ 0.2				~~0.9~~ 0.8			
Vector	S	A	-V	A	S	A	-V	A
1	0.8	0.2	-0.1	0.5	-0.1	0.4	-0.4	0.7
2	0.9	0.2	-0.2	0.3	-0.2	0.4	-0.[illegible]	0.[illegible]
3	0.4	0.2	-0	0.4	-0.1	0.3	-0.5	0.3
4	[illegible]	0.2	-0.2	[illegible]	0	0.3	-0.5	0.3
5	0.7	0.2	0.1	0.4	0.1	0.3	-0.3	0.2
6	[illegible]	0.4	-0.1	0.4	-0.1	0.3	-0.2	0.3
7	[illegible]	0.4	-0.2	0.4	-0.5	0.4	-0.8	0.4
8	1.3	0.2	0	0.[illegible]	0	0.[illegible]	-0.2	0.2
9	0.5	[illegible]	0	0.2	-0.4	0.4	-0.2	0.3
10	1.2	0.2	0.1	0.4	-0.4	0.2	-0.5	0.3
Average	0.88	0.24	0.05	0.37	-0.17	0.33	0.43	0.31
Minimum								
Maximum								

Time Start	1231				1231			
Time End	1236				1236			
Unit								
Location	U	C	L		U	C	L	
Depth	~~.05~~ 0.2				~~0.5~~ 0.8			
Vector	S	A	-V	A	S	A	-V	A
1	0.8	0.2	0.2	0.4	0.1	0.3	-0.2	0.3
2	1.5	0.2	-0.1	0.1	0	0.3	0.1	0.3
3	0.9	0.1	-0.1	0.2	-0.6	0.4	-0.4	0.7
4	0.7	0.1	-0.1	0.2	-0.1	0.5	-0.4	0.5
5	0.3	0	0	0.1	0.4	0.4	0.1	0.3
6	0.5	0.1	0	0.2	-0.3	0.3	-0.2	0.4
7	1.4	0.2	0	0.3	-0.3	0.4	-0.2	0.5
8	0.9	0.2	-0.1	0.3	-0.4	0.2	0	0.3
9	0.7	0.2	-0.2	0.4	0.1	0.4	-0.2	0.5
10	0.9	0.2	0	0.2	-0.2	0.5	-0.4	0.6
Average	0.86	0.15	0.06	0.24	-0.13	0.37	0.19	0.46
Minimum								
Maximum								

Notes:

C.33

Chandler Fish Screening Facility Flow Measurements

Forebay Elevation 630.0

Canal Flow 1030 cfs

Date 7/28/99

Personnel [illegible]

Sep Screen # 2

Screen Diameter (in)

Exposed (in)

Submerged (in)

Time Start												
Time End												
Unit												

Location	U C L				U C L				U C L				U C L				U C L				U C L			
Depth	0.2				0.8				0.08a				0.9				.05				0.5			
Vector	S	A	V		S	A	V		S	A	V		S	A	V		S	A	V		S	A	V	
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								

No measurements

Average																								
Minimum																								
Maximum																								

Notes:

C.34

APPENDIX D

EASTON SCRFENS RAW DATA SHEETS

APPEMDIX Q

EASTON SCREENS RAW DATA SHEETS

This appendix contains the raw data sheets for flow measurements taken at the Easton Screens on June 14 and 15. 1989. Page D.2 shows the calculations made to position probes at the proper depths and the raw data from measurements taken with a unidirectional flow meter. Raw data for measurements taken behind each of the drum screens with a bidirectional flow meter are found on pages D.3 through D-11.

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/14/89 Measurements Using Marsh McBirney Model 201 Canal = 1130 cfs CSa
CDa/PBT WATER CURRENT Meter

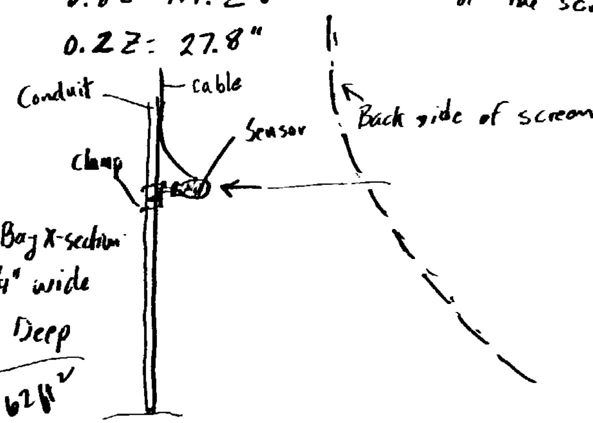
	0.2 DEPTH		0.8 DEPTH			
SCREEN	TIME	VELOCITY	TIME	VELOCITY	COMMENTS	Ave.
1	1258	0.15	1143	0.05		0.10
2	1300	0.15	1140	0.15		0.15
3	1301	0.20	1138	0.20		0.20
4	1303	0.20	1136	0.20		0.20
5	1306	0.30	1134	0.35		0.325
6	1307	0.30	1132	0.30		0.30
7	1414	0.35	1417	0.45		0.40
8	1412	0.35	1419	0.50		0.425
9	1408	0.45	1422	0.50		0.475
10	1343	0.35	1423	0.50		0.425
11	1341	0.35	1421	0.50		0.425
12	1340	0.40	1428	0.60		0.50
13	1309	0.40	1130	0.50		0.45
14	1310	0.40	1128	0.55		0.475
15	1311	0.45	1126	0.55		0.50
16	1314	0.40 *	1124	0.55	* Varied from 0.3 − 0.6	0.475
17	1315	0.55	1122	0.70		0.625
18	1317	0.45	1119	0.65		0.55
		.3444		18 0.4333		$\bar{X}$ = 0.39

NOTES 139" TOTAL Depth

Measurements taken • fi downstream side of screens at screen centerline
Sensor positioned ~ even with stoplog slots, • about 12"-18" downstream of the screen diameter.

0.8Z = 111.2 •

0.2Z: 27.8"



Screen Bay X-section
147 3/4" wide
139" Deep
142.62 ft²

The measurements were • made using •
Marsh- McBirney Model 201 water Current meter.

Measurements on Screens 1-6 and 13-18 were made when Screens 7-12 were not turning. (BR changing oil/ounwasters). All screens were very clean, however.

D.2

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/89
TIME START: 0901
TIME STOP: 0904

SCREEN # 1

Measurements with Marsh McBirney Model 511 Water Current Meter

Bypass Flow = 40 cfs (20 ea.) CAG

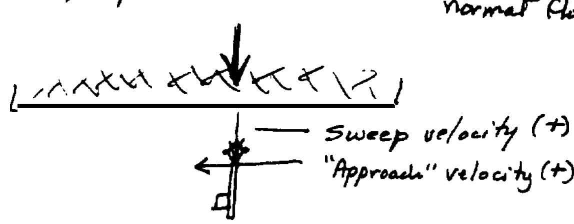
	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
2	-0.1	0	-0.1	0	
			-0.1	0	
3	-0.1	0	0	0	
4	0	0	0.1	0	
5	0.1	0	0.1	0	
6	0.1	0	0.1	0	
7 0.14	0.1	-0.1	0.1	0	
8 0.14	0.1	-0.1	0.1	0	
9	0.2	0	0.2	0	
10	0.2	0	0.1	0	
AVERAGE	0.06	-0.02	0.06	0	
MIN	-0.1	-0.1	-0.1	0	
MAX	0.2	0.	0.2	0	

DATE: 6/15/89
TIME START: 0909
TIME STOP: 0912

SCREEN # 2

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	0.1	0	0.2	0	
2	0.1	0	0.2	0	
3	0.2	0	0.2	0	
4	0.2	0	0.2	0	
5	0.2	0	0.3	0	
6	0.2	0	0.2	0	
7	0.1	0	0.1	0	
8	0.0	0	0.1	0	
9	0.0	0	0.1	0	
10	0.0	0	0.1	0	
AVERAGE	0.11	0	0.17	0	
MIN	0.0	0	0.1	0	
MAX	0.2	0	0.3	0	

Note: "Sweep" is velocity perpendicular to screens
"Approach" is velocity parallel to screens. + Reading is downstream, or normal flow direction.



EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/89
TIME START: 0916
TIME STOP: 0919

SCREEN #3

	0.2 DEPTH		0.8 DEPTH		
SCREEN I	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	0.2	0	0.2	0	
2	0.2	0	0.2	0	
3	0.1	0	0.2	0	
4 0.22	0.2	-0.1	0.2	0	
5	0.2	0	0.2	0	
6	0.1	0	0.2	0	
7	0.1	0	0.2	0	
8	0.1	0	0.2	0	
9	0.2	0	0.3	0	
10 0.14	0.1	0.1	0.2	0	
AVERAGE [illegible]	0.15	0	0.21	0	
MIN	0.1	-0.1	0.2	0	
MAX	0.2	0.1	0.3	0	

DATE: 6/15/89
TIME START: 0923
TIME STOP: 0926

SCREEN #4

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1 .14	0.1	0.1	0.2	0	
2 .36	0.3	-0.2	0.2	0	
3	0.2	0	0.3	0	
4 .14	0.1	0.1	0.2	0	
5 .32	0.3	-0.1	0.3	0	
6	0.3	0	0.3	-0.1	0.37
7 .22	0.2	0.1	0.3	0	
8 .22	0.1	0.2	0.3	0.1	0.32
9	[illegible]	0.2	0.2	0	
10 .22	0.1	0.2	0.2	0.1	0.22
AVERAGE [illegible]	0.17	0.06	0.25	[illegible]	[illegible]
MIN	0.0	-0.2	0.2	[illegible]	
MAX	0.3	0.2	0.3	0.1	

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/89
TIME START: 0929
TIME STOP: 0932

SCREEN #5

SCREEN	0.2 DEPTH SWEEP	0.2 DEPTH APPROACH	0.8 DEPTH SWEEP	0.8 DEPTH APPROACH	COMMENTS
1	0.2	0	0.2	0	
2	0.3	0	0.3	0	
3	0.2	0	0.3	0	
4	0.2	0.1	0.3	0	
5	0.2	0.1	0.3	0	
6	0.2	0	0.3	0	
7	0.2	0	0.3	0	
8	0.3	0	0.	0	
9 .22	0.2	0.1	0.4	0	
10	0.3	0	.41 0.4	-0.1	
AVERAGE .24	0.23	0.03	31 0.31	-0.01	
MIN	0.2	0.0	0.2	-0.1	
MAX	0.3	0.1	0.4	0.1	

DATE: 6/15/89
TIME START: 0936
TIME STOP: 0939

SCREEN #6

SCREEN	0.2 DEPTH SWEEP	0.2 DEPTH APPROACH	0.8 DEPTH SWEEP	0.8 DEPTH APPROACH	COMMENTS
1	0.2		0.4	I 0	
2	0.4	0	0.4	0	
3 .41	0.4	-0.1	.32 0.3	-0.1	
4	0.3	0	0.4	0	
5	0.3	0	0.3	0	
6	0.2	0	.32 0.3	0.1	
7	0.2	0	0.2	0	
8	0.2	0	0.3	0	
9 .22	0.2	-0.1		0	
10	0.2	0	0.3	0	
AVERAGE .26	0.26	-0.02	.33 0.33	0	
MIN	0.2	-0.1	0.2	-0.1	
MAX	0.4	0.0	0.4	0.1	

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/89
TIME START: 0942
TIME STOP: 0945

SCREEN #7

SCREEN	0.2 DEPTH SWEEP	0.2 DEPTH APPROACH	0.8 DEPTH SWEEP	0.8 DEPTH APPROACH	COMMENTS
1 .22	0.3	0.1	0.4	0	
2 .22	0.2	0.1	0.4	0	
3 .22	0.2	0.1	.32 0.3	0.1	
4 .22	0.2	-0.1	0.4	0	
5 .26	0.3	-0.2	0.3	0	
6 .20	0.3	0	.32 0.3	0.1	
7 .20	0.2	0	0.3	0	
8 .22	0.2	0.1	.32 0.3	0.1	
9 .20	0.2	0	0.3	0	
10 .22	0.2	0.1	0.3	0	
AVERAGE 0.25	0.23	0.02	.34 0.33	0.03	
MIN	0.2	-0.2	0.3	0	
MAX	0.3	0.1	0.4	0.1	

DATE: 6/15/89
TIME START: 0948
TIME STOP: 0951

SCREEN #8

SCREEN	0.2 DEPTH SWEEP	0.2 DEPTH APPROACH	0.8 DEPTH SWEEP	0.8 DEPTH APPROACH	COMMENTS
1 I	0.3	0	.41 0.4	-0.1	
2 .45	0.4	-0.2	6.4	0	
3	0.2	0	0.4	0	
4	0.4	0	0.4	0	
5 .41	0.4	-0.1	0.4	0	
6	0.4	0	.51 0.5	-0.1	
7	0.3	0	0.5	0	
8 .41	0.4	-0.1	0.5	0	
9 .41	0.4	-0.1	.41 0.4	-0.1	
10	0.4	-0.2	0.4	0	
AVERAGE .38	0.36	-0.07	0.43	-0.03	
MIN	0.2	-0.2	0.4	-0.1	
MAX	0.4	0.0	0.5	0.0	

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/89
TIME START: 0954
TIME STOP: 0957

SCREEN #9

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	0.3	0	0.4	0	
2	0.4	0	0.3	0	
3	0.3	0	0.3	0	
4	0	-0.1	0.4	0	
5	.61 0.6	-0.1	0.4	0	
6	0.2	0	.52 0.3	-0.1	
7	0.2	0	0.4	0	
8	0.3	0	0.4	0	
9	0.3	0	0.4	0	
10	0.2	0	0.4	0	
AVERAGE	0.27 0.28	-0.02	0.37 0.37	-0.01	
MIN	0.0	-0.1	0.3	- .	
MAX	0.6	0.0	0.4	0.0	

DATE: 6/15/89
TIME START: 1002
TIME STOP: 1005

SCREEN #10

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	.41 0.4	-0.1	0.3	0	
2	.32 0.3	-0.1	0.4	0	
3	0.5	0	0.7	0	
4	0.5	0	.61 0.6	0.1	
5	.54 0.5	-0.2	0.5	0	
6	.71 0.7	-0.1	0.5	0	
7	.61 0.6	-0.1	0.7	0	
8	.45 0.4	-0.2	0.5	0	
9	0.5	0	.71 0.7	0.1	
10	0.4	0	0.5	0	
AVERAGE .49	0.48	-0.08	.54 0.54	0.02	
MIN	0.3	-0.2	0.3	0	
MAX	0.7	0.0	0.7	0.1	

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/89
TIME START: 1009
TIME STOP: 1012

SCREEN #11

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1 .22	0.2	-0.1	0.5	0	
2	0.	0	.51 0.5	0.1	
3 .41	0.4	-0.1	0.5	0	
4	0.4	0	0.5	0	
5	0.4	0	0.5	0	
6 .22	0.3	-0.1	0.4	0	
7	0.3	0	0.5	0	
8 .22	0.2	0.1	0.5	0	-
9	0.2	0	.51 0.5	-0.1	
10	0.4	0	0.5	0	
AVERAGE 0.33	0.32	-0.02	0.49	0	
MIN	0.2	-0.1	0.4	-0.1	
MAX	0.4	0.1	0.5	0.1	

DATE: 6/15/89
TIME START: 1015
TIME STOP: 1018

SCREEN #12

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	0.3	0	0.6	0	
2	.41 0.4	-0.1	0.5	0	
3	0.3	0	0.5	0	
4	.41 0.4	-0.1	0.5	0	
5	0.3	0	0.5	0	
6	.41 0.4	-0.1	0.4	0	
7	.32 0.3	-0.1	0.5	0	
8	0.4	0	0.5	0	
9	.41 0.4	-0.1	0.5	0	
10	0.3	0	0.5	0	
AVERAGE&	0.35	-0.05	0.50	0	
MIN	0.3	-0.1	0.4	0	
MAX	0.4	0.0	.	0	

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/89
TIME START: 1022
TIME STOP: 1025

SCREEN #13

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	.41 0.4	-0.1	0.5	0	
2	0.4	0	0.5	0	
3	0.4	0	0.5	0	
4	0.5	0	0.5	0	
5	.41 0.4	-0.1	0.5	0	
6	0.4	0	0.5	0	
7	0.2	0	0.5	0	
8	0.3	0	.41 0.4	0.1	
9	.41 0.4	-0.1	0.5	0	
10	.41 0.4	-0.1	0.5	0	
AVERAGE	0. . 38	-0.04	0.49	0.01	
MIN	0.2	-0.1	0.4	0.0	
MAX	0.5	0.0	.5	0.1	

DATE: 6/15/89
TIME START: 1028
TIME STOP: 1031

SCREEN #14

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	0.3	0	0.5	0	
2	.61 0.6	-0.1	0.5	0	
3	.51 0.5	-0.1	0.5	0	
4	.41 0.4	-0.1	0.5	0	
5	.51 0.5	-0.1	0.6	0	
6	0.4	0	0.5	0	
7	0.5	0	0.6	0	
8	0.4	0	0.5	0	
9	.32 0.3	0.1	0.6	0	
10	0.6	0	0.5	0	
0,					
AVERAGE	0.45	-0.03	0.52	0	
MIN	0.3	-0.1		0	
MAX	6.6	0.1	0.6	0	

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/86
TIME START: 1034
TIME STOP: 1037

SCREEN # 15

SCREEN	0.2 DEPTH SWEEP	0.2 DEPTH APPROACH	0.8 DEPTH SWEEP	0.8 DEPTH APPROACH	COMMENTS
1 .5'	b/s-	-0./	.51 0.5	0.1	
2 .5'	0.5	-0.1	.32 0.3	-0.1	
3 .52	0.3	-0.1	0.6	0	
4 .24	0.2	-0.1	0.4	0	
5 .6'	0.6	-0.1	.73 0.7	0.2	
6 .22	0.2	-0.1	.32 0.3	-0.1	
7	0.5	0	0.4	0	
8 .5'	0.5	-0.1	.51 0.5	-0.1	
9	0.5	0	0.6	0	
10 .01	0.	-0.1 '	.51 0.5	-0.1	
	.45		0.49		
AVERAGE	0.44	-0. 8	0.48	-0.01	
MIN	0.2	- or /	0.3	-0.1	
MAX	0.		0.7	0.2	

DATE: 6/15/86
TIME START: 1041
TIME STOP: 1043

SCREEN # 16

SCREEN	0.2 DEPTH SWEEP	0.2 DEPTH APPROACH	0.8 DEPTH SWEEP	0.8 DEPTH APPROACH	COMMENTS
1	0.6	0	.61 0.6	or /	
2	0.5	0	0.6	0	
3	0.4	0	0.6	0	
4	0.6	0	0.7	0	
5	0.4	0	.61 0.6	0.	
6	0.6	0	0.	0	
7	0.5	0	0.7	0	
8	0.8	0	.	0.1	
9	0.4	0	0.6	0	
10	0.4	0	.51 0.5	0.1	
AVERAGE	0.52	0	0.61	0.04	
MIN	0.4	0	0.5	0.0	
MAX	0.8	0	0.7	0.1	

EASTON SCREENS FLOW MEASUREMENTS

DATE: 6/15/89
TIME START: 1046
TIME STOP: 1049

SCREEN #17

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	0.6	0	0.4	0	
2	.22 0.1	0.2	0.6	0	
3	.32 0.3	0.1	.61 0.6	0.1	
4	.41 0.4	-0.1	0.6	0	
5	.71 0.7	-0.1	0.6	0	
6	.41 0.4	-0.1	0.6	0	
7	.41 0.4	0.1	0.6	0	
8	.73 0.7	-0.2	0.6	0	
9	.41 0.4	-0.1	0.6	0	
10	0.5	0	0.6	0	
	0.47				
AVERAGE	0.45	-0.02	0.58	0.01	
MIN	0.1	-0.2	0.4	0.0	
MAX	0.7	0.2	0.6	0.1	

DATE: 6/15/89
TIME START: 1052
TIME STOP: 1055

SCREEN # 18

	0.2 DEPTH		0.8 DEPTH		
SCREEN	SWEEP	APPROACH	SWEEP	APPROACH	COMMENTS
1	.51 0.5	-0.1	0.5	0	
2	.51 0.5	-0.1	0.6	0	
3	0.5	[illegible]	0.6	0	
4	.61 0.6	-0.1	0.6	0	
5	.41 0.4	-0.1	0.5	0	
6	.54 0.5	-0.2	.5	0	
7	.51 0.5	-0.1	0.5	0	
8	0.5	0	.61 0.6	-0.1	
9	.51 0.5	-0.1	0.6	0	
10	.51 0.5	-0.1		.0.1	
	0.51				
AVERAGE	0.50	-0.09	0.56	-0.02	
MIN	0.4	-0.2	0.5	-0.1	
MAX	0.6	0.0	0.	0.0	